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CHANNEL PILOT

PART I.

SOUTH-WEST AND SOUTH COASTS
OF
ENGLAND.



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THE
CHANNEL PILOT,

PART I.

SOUTH-WEST AND SOUTH COASTS OF
ENGLAND.

COMPILED FROM VARIOUS ADMIRALTY SURVEYS.

THIRD EDITION.

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ADVERTISEMENT.

The Channel Pilot, Part I., contains sailing directions for the approaches to the English Channel, Scilly islands, and for the south-west and south coasts of England from Trevoze head, on the west coast of Cornwall, to the North Foreland.

The work is based on the original directions by the late Admiral Martin White, and the various Admiralty surveys executed between the years 1772 and 1868, as well as on information derived from local authorities.

It has been revised and corrected up to the present date by Staff-Commander G. F. McDougall, of the Hydrographical department, and supersedes the Second Edition in 1863, by John W. W. King, Master, R.N.

Seamen are invited to transmit to the Secretary of the Admiralty, notices of any errors or omissions they may detect, in order that the information may be made use of for the benefit of navigation.

G. H. R.

Hydrographic Office, Admiralty, London.
June 1869.



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**IN THIS WORK THE BEARINGS ARE ALL MAGNETIC
EXCEPT WHERE MARKED AS TRUE.**

**THE DISTANCES ARE EXPRESSED IN SEA MILES OF
60 TO A DEGREE OF LATITUDE.**

**A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO
100 FATHOMS.**

**THE SOUNDINGS ARE REDUCED TO THE DEPTHS OF LOW
WATER OF ORDINARY SPRING TIDES.**

THE CHANNEL PILOT.

PART I.

SOUTH-WEST AND SOUTH COASTS OF ENGLAND.

ERRATA.

- Page 19, line 3 from bottom, *for* 180, *read* 182.
,, 19, line 2 from bottom, *for* 130, *read* 152.
,, ~~57~~ 59, line 13 from bottom, *for* E. $\frac{1}{4}$ S., *read* W. $\frac{1}{4}$ N.
,, 57, line 4 from bottom, *for* miles, *read* cables.
,, 212, line 12 from top, *for* 28, *read* 30.
,, 247, line 6 from top, *for* lat. $49^{\circ} 53' 31''$, *read* $49^{\circ} 53' 33''$.
,, ,, ,, *for* long. $6^{\circ} 20' 41''$, *read* $6^{\circ} 20' 38''$.
,, ,, line 7 from top, *for* lat. $50^{\circ} 3' 10''$, *read* $50^{\circ} 3' 37''$.
,, ,, ,, *for* long. $6^{\circ} 7' 20''$, *read* $6^{\circ} 4' 37''$.
,, ,, line 8 from top, *for* lat. $49^{\circ} 56' 41''$, *read* $49^{\circ} 56' 43''$.
,, ,, ,, *for* long. $5^{\circ} 48' 30''$, *read* $5^{\circ} 48' 27''$.

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are the seaman's only guide.*

It should ever be borne in mind when approaching the Channel, that even under the most favourable circumstances the frequent use of the lead is desirable; but when from the state of the weather and the consequent absence of celestial observations a ship's position is dependent on dead reckoning, the lead becomes of primary importance, and its constant use indispensable to safe navigation. It is true that the soundings in deep water, say outside the 20-fathom line, cannot be depended upon with the desired exactitude, yet experience has proved that the depths may generally be trusted, to within two or three fathoms.

Many vessels, by neglecting this simple precautionary measure have

* See Admiralty Charts, English Channel, 3 sheets, Nos. 2,675 (α to c); scale, $\alpha = 9$ inches.

been found within the Scilly Islands, unconscious of their position ; and instances are only too numerous where such neglect has resulted fatally to ships and crews among the dangerous Minquiers rocks, or the coast of France. Such disasters are all the more lamentable when, humanly speaking, they might have been averted by simply using the lead and obtaining a continuous line of soundings.

It must not, however, be supposed that an occasional cast of the lead is all that is required, when, from the state of the weather or other causes, there is doubt respecting the exact position of the ship ; for, as will be shown hereafter, an occasional cast *only* may possibly be a fruitful source of danger. By referring to the bank of soundings at the entrance of the channel, it will be self evident that a continuous line of soundings is essentially necessary, for the depths on the plateau are very irregular, and comparatively shallow soundings of the same depths will be found as far off as the 10th meridian of west longitude, as well as near the land.

The decreasing depths of water therefore are too irregular to act as a guide, nor is the quality of the bottom of a sufficiently distinctive character to be relied on ; for instance, when approaching on the parallel of Scilly or $49^{\circ} 53' N.$ the depth of 73 fathoms may be struck 150 miles off the Scilly islands, as well as within 50 miles of the group, and although at the outer sounding the bottom is generally of fine sand, whilst at the inner sand and oaze prevail, the distinction is too slight to be serviceable.

A similar difficulty may be experienced on what is generally considered the best parallel for approaching the channel, viz., $49^{\circ} 20' N.$; here a depth of 73 fathoms, fine sand, may be found in long. $10^{\circ} 20' W.$, and the same depth and similar bottom may be met with 125 miles further to the eastward on the channel course. The cases cited above are sufficient to illustrate the absolute necessity for continuous soundings ; for, supposing a ship should be deemed to be on the outer spot, whilst she was actually on the inner, the result might be most disastrous ; whereas, had frequent soundings been obtained, the comparison of the intervening depths between the two positions with those marked on the chart would give increased confidence, and lessen the possibility of mistake. Thus frequent sounding should be the rule, and seamen would do well to bear in mind that the value of the lead is enhanced in proportion to the frequency of its use.

Compasses.—Strict attention should also be paid to the deviation of the compass, as neglecting to apply it may—especially in iron vessels—cause great error in the latitude ; and as in the majority of cases the deviation on the channel course is easterly, the error would lead a vessel to the southward of her supposed position, and thus endanger her safety, if running on the parallel of Ushant, or on the south side of the English channel.

When returning from a distant voyage in southern latitudes, it would be a useful precaution previous to entering the channel, particularly in an iron vessel, to take advantage of fine weather, and place the ship's head for a short time on the usual channel course, in order to determine the deviation from actual observation of the sun, or other heavenly bodies.

There is now, however, supplied to all Her Majesty's ships tables of time bearings, which almost set aside the necessity for computation ; for by their means, and a single compass bearing of the sun, the combined amount of variation and local deviation is determined by inspection, and the value of such knowledge, so easily attainable when approaching narrow waters, say the English channel, after a long voyage, must be too apparent to the practical navigator to require comment.

By means of these simple elements, viz., apparent time at the ship to the nearest minute, latitude, and sun's declination (the two last need only be approximate), the sun's true bearing is found in the tables ; and if at the same time the sun's compass bearing be taken, the difference must be the *whole error* of the compass ; and as the geographical variation can always be procured from the Admiralty chart of magnetic curves, it is evident that the difference between it and the *whole error* must be the deviation for that point of the compass to which the ship's head was directed when the observation was taken. Thus, in mid-ocean, the sun will ever prove a check on the compass, and the silent monitor need no longer be distrusted.*

When the horizon is tolerably clear by night, the planets, bright fixed stars, and pole star, may frequently be used for determining the latitude, and if the meridional altitudes of two stars, one north and one south, be obtained, the mean result—supposing the observations to be made with care—would probably be within 2 or 3 miles of the truth. The longitude may also be obtained from observations of stars east or west, and if deemed necessary the true azimuth of the object may also be determined at the same time. No opportunity should be lost of ascertaining the ship's real position, and the navigator would do well to avail himself of the various methods by which the merest chance observations of heavenly bodies may be turned to account, including the simple and ingenious problem known as "Sumner's method."

Currents.—As the most watchful efforts to obtain an observation may fail, it is necessary in shaping a course up channel to review the lately prevailing wind and weather, in order to make allowance for the apparent set of the swell, and influence of any probable current. This last consideration

* The Sun's True Bearings, or Azimuth Tables computed for intervals of four minutes, between the parallels of lat. 30° and 60° inclusive, by Staff Commander John Burdwood, R.N., Naval Assistant in the Hydrographic Department, Admiralty, 1866.

will, however, require great caution, for the currents of these seas being merely the prolonged movement of the water produced by recent, and possibly remote gales ; the actual direction of the movement may differ from the apparent run of the swell.

Should the distant storm be surmised to have blown from the S.W., the probability would be in favour of the resulting current setting towards the Irish coast, and up the Irish channel ; or if the gale be supposed to have been from the westward, that the current would be running to the eastward, and unite with the set into the English channel.

Too much confidence however must not be placed in such inferences ; for it has been clearly shown by the late Major Rennell that in certain cases the long ocean swell rolled in by westerly gales to the Bay of Biscay, accumulates there so as to form in the bight of that gulf a head of water, which cannot return to the westward along the Spanish shore, in consequence of the incoming swell, and therefore pours itself out along the coast of France, to the north-westward, thus forming a temporary but decided current, obliquely traversing the line of entrance to the English Channel, and occasionally extending beyond the south-west angle of Ireland. It does not appear, indeed, that this phenomenon is of frequent occurrence, but to a vessel without means of rectifying her latitude, the consequences of being swept to the northward of Scilly in the course of a night might be disastrous, and therefore every navigator should be alive to the possibility of being entrapped by this unexpected and anomalous current.

The BEST PARALLEL for entering the Channel is between $49^{\circ} 15'$ and $49^{\circ} 25' N.$, according to the inclination of the wind ; because between those limits the position of the vessel can be ascertained with the least degree of uncertainty, not only as regards the depth of water, but also the quality of ground (oaze or sand), which is not so well defined in any other latitude. The keeping on this parallel is rendered more necessary, in consequence of the rotary motion and northerly inclination of the tide, westward, south-westward, and southward of Scilly.

Between these parallels the 100-fathom edge of the bank of soundings will be found in long. $10^{\circ} 55' W.$, and the ground a mixture of sand and dark greenish oaze. A depth of 335 fathoms sand and oaze, has been found in $11^{\circ} 30' W.$, but it is very rarely that a ship strikes soundings outside the 100-fathom edge. Proceeding towards the Channel from the meridian of $10^{\circ} 55' W.$, sand and oaze will be found for about 25 miles farther eastward, the depths then decreasing from 80 to 70 fathoms, and the ground changing to coarse and fine reddish-yellow sand and shingle. This is the surface of the Great Sole bank which lies athwart this parallel

nearly at right angles, its length being about 36 miles, and its breadth 9 miles. The southern part of the bank is in lat. $49^{\circ} 4' N.$, long. $9^{\circ} 55' W.$, trending thence in a N.N.W. direction.

Passing this bank the water will again deepen to 80 fathoms, and the bottom will be again sand and oaze, until as far eastward as long. $9^{\circ} 30' W.$, when it will again change to clean sand, whence no more oaze will be obtained so long as the parallel of $49^{\circ} 17' N.$ is preserved; on the contrary, if oaze forms any part of the substances brought up by the lead, after passing this meridian, the vessel must be to the northward of $49^{\circ} 17' N.$, as there is no oaze to the southward of this parallel, when eastward of long. $9^{\circ} 30' W.$

On the parallel of $49^{\circ} 25' N.$, however, oaze will be found in long. $8^{\circ} 40' W.$, though it will be again lost in long. $7^{\circ} 50' W.$; here the depths suddenly decrease from 75 to 62 and 58 fathoms, the bottom being composed of coarse light-yellow and dark-grey sand alternately with shingle. This is the surface of the Haddock bank, which crosses this parallel in a north-easterly direction, and from the southern end of which Scilly bears E. $\frac{1}{2}$ N., 70 miles. Passing this bank, the water will again deepen, with oaze and sand mixed; the oaze will eventually be lost at 18 miles farther eastward, or in long. $7^{\circ} 20' W.$

On the **PARALLEL of FASTNET ROCK**, or that of $51^{\circ} 23' N.$, and in long. $11^{\circ} 34' W.$, are 286 fathoms water, the ground a sort of fine dark viscous brown sand. Thence, in proceeding eastward, the depths will decrease suddenly. In long. $11^{\circ} W.$ are 96 fathoms, fine dark sand, and hence to long. $10^{\circ} 30' W.$ the depths decrease more gradually—about 4 fathoms every 5 miles—but again decrease suddenly until within 16 miles of the land. At the distance of 21 miles westward of Mizen head there are 60 fathoms, and 9 miles farther off 80 fathoms oazy ground will be found.

If bound for the **BRISTOL CHANNEL** from the Atlantic, vessels may keep the parallel of Trevoise head, or that of $50^{\circ} 30' N.$, with a view of counteracting the north-westerly and northerly excess of tide which prevails in the Irish channel, because this promontory projects a considerable distance north-westward beyond the general direction of the Cornish coast. The land also, being high and steep, renders it an eligible spot for a landfall between the Lands End and Hartland point, whence a vessel may with confidence shape a course for the Bristol channel. On this parallel the 100-fathom line will be struck in long. $10^{\circ} 40' W.$

But if at all certain of his latitude, the mariner should run for Lundy island, which is high bold land, and in clear weather the lights may be seen 30 miles. If foggy, the leads give good warning of the approach, as

5 miles to the westward of the island the 30-fathom edge will be struck, and all within or to the eastward is of less depth. Should no land be seen on striking 30 fathoms, the ship should proceed with the utmost caution, but may go on 25 miles beyond Lundy, towards Swansea or Cardiff, provided she does not shoal the water to less than 20 fathoms.

The NYMPH BANK may be defined as a broad flat, or southern expansion of the shelf or shore bank of the south coast of Ireland, between the meridians of the Old Head of Kinsale on the west and the Saltees on the east, at about 35 miles off shore. It appears to be comprised between the limits of the 40 and 50 fathom lines of soundings, and the bank may be considered as 70 miles long from east to west by an average width of 25 miles; its broadest part being 40 miles, a little west of the meridian of Waterford. The general quality of the bottom is mud, sand, and shells to the westward, clay and stones in the middle portion, and sand with oaze to the eastward; the depths are rather irregular, varying between 40 and 50 fathoms, on an average perhaps 45 fathoms at low water.

The bank abounds with cod, hake, and ling, particularly between the months of April and September, and is much frequented on this account by Irish fishermen. The tide causes numerous rippings over it, and when the wind blows strong the sea breaks heavily, particularly when opposed to the tide.

On a radius of 48 miles from the Smalls lighthouse, in any direction between N.W. by W. and S.W., the bottom is almost exclusively composed of oaze, or oaze and sand. To the north-westward, as well as to the eastward of these limits, the bottom suddenly becomes a sort of dark-reddish sand, which ground is the peculiar criterion of an approach to the Bristol channel. In running from the westward, therefore, for the mouth of this channel, if the ground brought up by the lead be oaze, or oaze and sand, the vessel cannot be southward of lat. $50^{\circ} 57' N.$, but must be northward of that parallel, and westward of the meridian of Grassholm, let the depth be what it may. If, on the contrary, the soundings are wholly free from oaze, she must be eastward of the latter meridian. The transition from oaze to sand in this neighbourhood is so evident that it cannot be mistaken.

On the PARALLEL of SCILLY, or that of $49^{\circ} 53' N.$, the 100-fathom edge will be struck in about long. $10^{\circ} 45' W.$, with fine dark-brown sand. Proceeding on this parallel, the depths fluctuate between 80 and 70 fathoms. as far eastward as long. $9^{\circ} W.$, where, on the northern part of a small knoll called Cockburn bank, there will be 67 and 60 fathoms over a bottom of sand; thence to long. $8^{\circ} 20' W.$ the soundings rather increase, and again decrease towards long. $8^{\circ} W.$, near which meridian the depths will

suddenly fall to 40 fathoms; this is the south-western edge of Jones bank.

The shoalest part of Jones bank, with 39 fathoms, in lat. $49^{\circ} 53' N.$, long. $7^{\circ} 58' W.$, is distant from Scilly 63 miles, and on the same parallel. The portion of the bank having less than 50 fathoms appears to extend about 7 miles in an east and west direction; there is also a shoal patch of 51 fathoms 9 miles farther to the north-east. The bank has 65 to 70 fathoms close-to, and is composed of fine and coarse gray and yellow sand, interspersed with brittle shelly substances and minute yellow, reddish, angular stones, but the ground around is wholly oaze. The tide causes great ripples on all parts of it, but particularly between the periods of 4 hours' ebb and high water. There are several other small knolls or banks between it and the Nymph, though none have less water than 55 fathoms, but no bank exists between it and the Scilly islands.

The soundings 18 miles from the Scilly islands, in any westerly direction between the limits of N.N.W. and S. $\frac{1}{2}$ W., do not materially differ; the depths are from 55 to 60 fathoms, whence they shoalen pretty gradually towards the rocks. The ground to the southward of the islands within the above radius, though in quality nearly the same, is somewhat finer and more tenacious than that to the westward and north-westward. The bottom, however, in both cases consists chiefly of fine or coarse sandy-mixed ground of a pale, white, or grayish colour, which becomes coarser and darker coloured in approaching Scilly, with a mealy surface, interspersed with small stones, and pieces of shells; but there is no oaze, nor any matter that can be mistaken for it at, or within, the above distance from the islands, in any direction; and, moreover, the transition from oazy ground to that of any other quality, northward, westward, and south-westward of Scilly, is always evident, the alteration being manifest even on the distance of one mile.

The soundings to about 36 miles from Scilly in any westerly direction between the limits of N.N.W. and S. $\frac{1}{2}$ W., are from 63 to 67 fathoms; and if oaze forms any part of the substances brought up by the lead, the vessel can neither be to the southward of lat. $49^{\circ} 38' N.$, nor to the northward of lat. $50^{\circ} 17' N.$, but must be upon or between those parallels. On the other hand, if under the above circumstances, the ground be fine or coarse sand, of nearly the colour and consistency of beaten pepper; or light grey sand; or reddish brown sand, with minute pieces of shells; or, indeed, of any quality in which oaze forms no part, she cannot be between those parallels; but must be upon or to the northward of $50^{\circ} 17' N.$, or upon, or to the southward of, $49^{\circ} 38' N.$, and nearly in the Channel fair-way.

In thick weather the Scilly islands should not be approached within

the depth of 60 fathoms, as the vessel will not then be more than 15 miles from the rocks.

On the **PARALLEL** of **USHANT** (Ile d'Ouessant) or in $48^{\circ} 28' N.$, the 100-fathom edge of soundings is struck in $10^{\circ} 45' W.$ and at 20 miles to the eastward the water shoals are 87 and 84 fathoms; the latter depths are on the north-western part of the Little Sole bank, and the soundings continue irregular until as far eastward as long. $8^{\circ} W.$ The general direction of the 100-fathom edge of soundings between the parallels of 49° and $51^{\circ} 30' N.$ appears to be about N.N.E. $\frac{1}{2} E.$ and S.S.W. $\frac{1}{2} W.$ From lat. $49^{\circ} N.$ the edge of the bank suddenly trends away to the south-eastward, and 70 miles S.W. of this spot Captain Dayman, R.N., got a cast of 2,275 fathoms.

In lat. $48^{\circ} 55' N.$, long. $10^{\circ} 51' W.$, there are 217 fathoms, ground wholly oaze, of a dark muddy-greenish colour; and 12, 15, and 21 miles to the south-eastward of this position, there is no bottom at 230 fathoms. In lat. $48^{\circ} 28' N.$, long. $9^{\circ} 45' W.$, are 107 fathoms, sand and oaze; and 2 miles only to the southward of this, no bottom could be found with 200 fathoms; alternating in the same manner towards the southern part of the Little Sole bank, whence the edge of soundings is distant only 8 or 9 miles.

The southern part of the Little Sole bank is in lat. $48^{\circ} 18' N.$, long. $8^{\circ} 50' W.$, and thence trending in a northerly, north-westerly, and westerly direction, it occupies a space of about 27 miles from N.W. to S.E., and nearly the same in an easterly and westerly direction. This bank, like that of the Nymph, shoals in patches from 88 to 66 fathoms, all of which are steep-to, having between them from 90 to 138 fathoms. The shoalest part, 66 fathoms, is 153 miles W. by N. $\frac{3}{4} N.$ from Ushant lighthouse, and the quality of the ground on the bank is coarse or of fine greyish sand, mixed with small reddish-black and yellow pebbles, and pieces of various shells. The bank, as well as the whole extent of the edge of soundings, may always be discovered in fine weather from the numerous rippings in its vicinity, and in boisterous weather the transition from deep water to shoal, is rendered apparent by the sudden alterations in the colour of the water, which changes from blue to that of a disturbed green.

Passing the Little Sole bank the depths will be from 95 to 90 fathoms, fine light coloured sand and pieces of ribbed shells; and on the same parallel, 15 miles farther eastward, and 135 miles from Ushant they will decrease to 88 fathoms, though the bottom is nearly the same in quality. As Ushant is approached, though the depths decrease, they will be found to vary only a few fathoms throughout a considerable distance; for instance, at the distance of 48 miles from, and on the parallel of Ushant, they will be 72, 71, and 70 fathoms, with a sort of coarse pale yellow ground, resembling

semi-indurated marl, and a mealy surface, interspersed with broken pieces of shells, and a substance like chaff. At the distance of 27 miles from the island, the soundings are from 66 to 63 fathoms, with ground of a similar description, and 65 fathoms will be found within 9 miles of the rocks. In thick weather, therefore, when approaching Ushant, do not come into less water than 70 fathoms, and keep the lead constantly going.

On the parallel of the *Chaussée de Sein* (commonly called the Saints,) the transition from deep to shoal water is very sudden; in lat. $48^{\circ} 2' N.$, long. $8^{\circ} 4' W.$, 396 fathoms were obtained, the bottom being dark bluish-gray mud; whilst only 8 miles westward of this position the depth was 529 fathoms; and the whole of the south-western edge of the bank on which the British Isles and the north-western portion of France rests appears to be equally steep. In the parallel of Rochelle, a depth of 900 fathoms was obtained, 30 miles westward of the 100-fathom edge of the bank, and 2,275 fathoms at 60 miles.

BEST LINE OF APPROACH.—After due consideration of the foregoing statements, it will be manifest, that vessels bound into the Channel from the south-westward in thick weather, and uncertain of their position, should run well to the northward, when eastward of the meridian of $10^{\circ} W.$, until oaze forms part of the soundings; and that coming from the north-westward they should, for the same reason, borrow well to the southward, when eastward of that meridian, until the soundings are free from oaze; thus ensuring a safe parallel to run on to the eastward.

As, during the prevalence of strong southerly and westerly winds, the tides are warped more astream than usual, and found to run considerably longer, as well as with greater velocity, between the North and West, than at other periods, it is recommended,—having in view the preservation of any particular parallel,—that when running from the edge of soundings towards the Channel during spring tides, and with the wind blowing strong from between South and West, the course should be shaped half a point more to the southward than usual.

SOUNDINGS OF SCILLY.—When running upon either of the parallels of $49^{\circ} 15'$ and $49^{\circ} 25' N.$, or anywhere between them, if the water shoals to 68 and 66 fathoms, with soundings of fine sand, mixed with pieces of white and yellow shells, and minute brown angular granite, as well as other stones of different shapes, unconnected with oaze, Scilly will bear nearly E.N.E. and be distant about 40 miles; the depths for 24 miles farther eastward will not materially vary nor decrease. On the meridian of Scilly there are 65 and 60 fathoms on the parallel of $49^{\circ} 25' N.$, and 67 fathoms on the parallel of $49^{\circ} 15' N.$ Here, however, the soundings will be coarse sand, mixed with rotten rocky substances and flat shells;

and thence by steering E. $\frac{1}{4}$ S. 45 miles, a land-fall will be made about the Lizard.

SOUNDINGS off the LIZARD.—There are 49 and 47 fathoms on the meridian of the Lizard when 12 miles from it, and 51 fathoms at the distance of 24 miles. In running for this position on the above E. $\frac{1}{4}$ S. course, the depths will shoal gradually from 67 to 52, the proportion being about 4 fathoms every 9 miles ; but the ground, after passing the meridian of Scilly from either of the above parallels, will change to a pale whitish colour,* resembling that of semi-indurated marl with a mealy surface, a peculiarity which continues as far eastward as the meridian of the Ile de Bas, on the French shore, and thus confirm the vessel's relative position in respect to Scilly and Ushant. The bottom on the meridian of the Lizard, in the depth of 51 fathoms, will be of a corresponding description, with a variety of broken shells.

The soundings off the Lizard, at and between the distances of 21 and 15 miles, in any direction between W. $\frac{3}{4}$ S. and S. by E. $\frac{1}{4}$ E., do not materially differ, the greatest variation being from 51 to 45 fathoms ; and thence the depths gradually decrease towards the Lizard, within 3 miles of which are 40 fathoms. At 5 and 4 miles to the south-eastward of the Lizard the soundings are 5 and 4 fathoms deeper, and the ground coarser, than those at similar distances to the south-westward and southward of it.

The **FAIRWAY** of the Channel, when eastward of Ushant or the Lizard, should always be considered as within the limits of 12 and 24 miles from the English coast, if the wind will permit ; not only in consequence of the dangers which exist on the opposite coast, but because the depths increase and decrease more *progressively* on the English than on the French shore.

Generally speaking, the water in the entrance of the Channel is from 8 to 10 fathoms deeper towards the French coast than towards the English. The soundings, too, are coarser, the stones are larger, and the different substances altogether more loose and unconnected, and the compound of a paler colour than on the northern side of the Channel.

A close attention, therefore, to the peculiar character of the soundings, together with the remarkable rippings and overfalls which so generally prevail, even in the finest weather, off the French coast, will always verify the vessel's position, as to whether she be to the northward or southward of the Channel fairway.

Should the vessel, however, after being as far eastward as the Start, in

* This is invariably the colour of the ground when to the southward of the fairway.

her progress up Channel, be thrown to the southward of the fairway, or should a scant southerly wind, with indications of a gale, make it necessary to gain an offing to the southward, and, in doing so, the water is found to suddenly deepen from 37, 39, and 40 fathoms to 50, 55, and 60, it may with confidence be concluded that she is in or near the stream, or parallel of the Casquets; either in Melville Pit, or the south-western part of Hurds Deep; or if the soundings deepen from 45 to 70, 80, or even 95 fathoms, that she is in the northern part of Hurds Deep; in either case she should haul to the northward into the fairway, carefully bearing in mind the set of the tide.

Melville Pit is 33 miles W.N.W. of the Casquets; in its centre, which is of small extent, there are 62 fathoms water. The south-western portion of Hurds Deep is 37 miles W. $\frac{1}{2}$ N. from the Casquets, with general depths of from 50 to 60 fathoms; it thence trends round the northern side of the Casquets, stretching away north-eastward of Alderney, nearly as far as the meridian of Cape de la Hague; and in this part of the Deep the soundings range from 60 to 95 fathoms. From the latter depth the Casquets bear S.W. by S. distant 8 miles, and from the depth of 92 fathoms they bear S.S.E. $8\frac{1}{2}$ miles. Between these positions, a distance of $7\frac{3}{4}$ miles, is the deepest part, and the soundings vary from 81 to 93 fathoms. Though other discrepancies may be traced among the soundings in various parts of the Channel, there are no such corresponding transitions, from shoal water to deep, to be found anywhere else; no doubt, therefore, should ever arise as to position.

The SCILLY ISLANDS, and rocks in their vicinity, lie about 21 miles westward of the Lands End of England, and occupy a space of about 47 square miles. The group consists of 48 islands, but of these only five, viz., St. Mary, St. Agnes, St. Martin, Trescow, and Bryer, are inhabited; of the others, 18 are capable of bearing grass, but the remaining 25 are barren. Besides the above, all of which are tenanted by gulls and rabbits, the rocks above and below water are too numerous to admit of description. The chief exports are early potatoes, many tons of which are annually shipped to London and Bristol, and lobsters. The imports consist of timber, coals, flour, bread, and general merchandize. Coals are put on board steamers at 30s. and water at 15s. per ton; but fresh provisions are not immediately obtainable.*

These islands may be discerned in clear weather at the distance of 15 miles; and by night the light on the summit of St. Agnes may be seen from about the same distance. In the year 1637 a conical stone beacon, or day mark, 38 feet high, was erected on the eastern point of St. Martin; it

* See Admiralty Chart of Scilly Islands, with Views, No. 34; scale, $m = 3$ inches.

is painted with red and white horizontal bands, and its summit is 185 feet above the level of high-water ordinary springs. This beacon, together with the telegraph-tower on the highest part of St. Mary, the old windmill on Peninnis head, the south point of that island, and the Star fort on its western end, are good landmarks, and serve well to point out this dangerous group.

The near approach to these islands from the south-westward and westward requires great judgment, by reason of the rocky ledges which project in those directions, the principal of which are the Nundeeps, Crim, Bishop, Crebinack, Bishops ridge, and Shovel. The Crim and Bishop, the westernmost rocks of Scilly, are always above water, and on the latter is a stone lighthouse. The tide at a little to the south-westward of the Crim and Bishop runs strong to the north-westward, north, and north-eastward 8 hours out of 12. The south-eastern shores of St. Agnes, St. Mary, and Menewethan islands may be approached as near as half a mile, as there are no dangers without that distance.

From the rocky ledge called the Poll bank, St. Agnes lighthouse bears E. by N. $\frac{1}{4}$ N. $6\frac{1}{3}$ miles, but it carries a depth of 15 or 16 fathoms, is surrounded by deep water, and is in no case dangerous, otherwise than to open boats in boisterous weather. The old windmill on Peninnis head in line with Goreggan islet (a quarter of a point open eastward of the lighthouse), leads directly to it.

ST. MARY'S ISLAND, the largest of the Scilly group, is $2\frac{1}{2}$ miles long from north to south, and $1\frac{1}{4}$ miles broad ; it attains an elevation of 128 feet, and has a population of 1,424. The little town of St. Mary, consisting of 204 houses, contains a church, two chapels, three schools, a resident clergyman, who also serves St. Martin, and a market house. There are also three building slips, with blacksmith's shops, two piers, several wells, and a tank capable of containing 3,400 gallons of water.

TRESCOW ISLAND is 2 miles long north and south, and one mile broad ; it contains 600 acres, and a population of 399 ; and has a church, national school, and resident clergyman. An ample supply of water is obtained from five wells in different parts of the island.

Trescow look-out, with a flagstaff at an elevation of 124 feet, is used as a signal station between the lighthouses and Seven Stones light-vessel ; and on the sight of an old abbey stands the residence of Mr. A. Smith, M.P., the proprietor of the whole group.

ST. MARTIN'S ISLAND, the north-easternmost of the group, is about 2 miles long N.W. and S.E., and two-thirds of a mile broad ; it contains 520 acres, 134 houses, a church, chapel, and has a population of 185. The most remarkable object is the beacon known as the Day-mark, which

stands on the highest and eastern part of the island at an elevation of 147 feet, the beacon being 38 feet high, and painted with alternate red and white horizontal bands.

BRYER ISLAND is $1\frac{1}{2}$ miles long from north to south, two-thirds of a mile broad, and attains an elevation of 133 feet. It contains 292 acres, three wells, 30 houses, and a population of 115; there is a pilot's look-out on Watch hill, the highest point of the island.

ST. AGNES ISLAND, separated from St. Mary's by the sound, is one mile long, and three-fourths of a mile broad; it contains 269 acres, including Gugh islet, with which the island is connected by a narrow neck covering at three-quarters flood. The island contains a church, chapel, a resident clergyman, and a population of 200, who are well supplied with good water from four wells.

ST. AGNES LIGHT.—The lighthouse, 74 feet high, and painted white, stands on the summit of St. Agnes island, and exhibits at an elevation of 138 feet above high water, a *revolving* white light, which attains its greatest brilliancy every *minute*, and in clear weather should be visible from a distance of 17 miles, except between the bearings of S. by W. and West, when it is only seen at short intervals, being obscured by the northern islands of the group.*

The first darkness is occasioned by Gweal, when that islet bears S. by W. The light is then visible from that bearing to S. by W. $\frac{1}{2}$ W., with the exception of a momentary darkness by Gweal hill on Bryer island; it is then obscured from S. by W. $\frac{1}{2}$ W. to S.W. $\frac{3}{4}$ S., being only momentarily seen over the neck of Trescow island; and it is again visible from S.W. $\frac{3}{4}$ S. to S. W., with only two short intervals of darkness by the higher parts of Tean islet. From S.W. the light is shut in by St. Martin's island, and is not again visible until it reappears bearing West over Peninnis head, the south extreme of St. Mary's island.

PILOTS.—Strangers are recommended not to attempt the harbours of Scilly without pilots, whose attendance may always be depended on, even in the worst weather, as soon as the signal for that purpose is made. There are no fewer than 11 vessels distributed amongst the islands, and the conduct of the pilots is marked by skill and intrepidity.

A rocket apparatus is kept in the coast-guard watch-house, near the custom-house at St. Mary, in case of shipwreck.

* In some directions and in some states of the atmosphere the bright face of St. Agnes revolving light may be seen before the fixed light of the Bishop; the mariner therefore should be on his guard.

BISHOP ROCK and LIGHT.—The Bishop rock on which the lighthouse stands, is the highest of a cluster forming the south-westernmost of all the dangers of the Scilly group. These rocks are half a mile in extent, and were formerly dreaded in consequence of their off-lying position; but the erection of a light-tower has converted the danger into a safety beacon, and given increased confidence to the mariner when closing the islands from the south-west.

The lighthouse, of stone and painted white, is 147 feet high, and from an elevation of 110 feet above high water exhibits a fixed white light, which should be seen in clear weather from a distance of 16 miles all round the compass, excepting between the bearings of S. W. by W. and W. by N. $\frac{1}{4}$ N., when it is obscured by the intervening land of the group, a ray of light only being seen in a W. by S. direction, between the islands of St. Martin and St. Mary. The lighthouse bears W. $\frac{3}{4}$ N. 4 miles from the lighthouse on St. Agnes island. A bell is sounded during foggy weather.

Grimsby Rocks consist of a cluster of dangers six-tenths of a mile in length N.N.E. $\frac{1}{2}$ E. and S. S.W. $\frac{1}{2}$ W.; and of these the most conspicuous is the Peaked rock, 6 feet high, which lies $1\frac{1}{2}$ miles N. $\frac{3}{4}$ E. from the Bishop lighthouse. The intervening passage is upwards of a mile across, and is the entrance of the channel known as Broad sound, which is fringed with dangers on either side, and is narrowed to less than half a mile between Le Jeffrey and Old Wreck shoals.

Broad sound is one of many others leading into St. Mary road, but as the landing marks are distant and not easily identified, the place should never be attempted by a stranger.

ST. MARY ROAD.—The Scilly islands possess several harbours for vessels capable of taking the ground, and also one for those of large draught, viz., St. Mary road; though the ground, being loose sand, is not very tenacious, and, indeed, this is the case generally, for the anchors come home long before a stay-peak can be obtained. The harbours in most esteem are Old and New Grimsby, and St. Helens pool. St. Mary road affords shelter from all winds, except those from the westward between W.N.W. and S.W.; those bring in with them a heavy fetch, but a vessel can run to sea through Crow sound, at a proper time of tide; and to enable her to do this, the following elevations of the Crow rock above the surface of the water are given.

This rock lies off the north end of St. Mary, near Bants-carn point, and has an iron beacon with cage, erected on it. It is remarkable in having three distinct heads, called Great Crow, Little Crow, and Crow Foot, by which the height of water over Crow bar may be estimated; the

bar, however, varies in gales. The Great Crow is nearly awash at 5 hours' flood; the Little Crow is awash at about 4 hours' flood, or after 2 hours' ebb; and the Crow Foot is nearly awash at one quarter flood, or three quarters ebb. At high water, ordinary springs, there are 21 feet on Crow bar; at three quarters flood, or one quarter ebb, 17 feet; at half flood or half ebb, 11 feet; at one quarter flood, or three quarters ebb, 5 feet; and at low water one foot; but more with westerly gales, and less with those from the eastward.

The anchorage in St. Mary road is between the island of St. Mary and that of Samson, and there are five distinct entrances to it, as shown on the chart, viz., St. Mary sound; Smith sound; Crow sound, over Crow bar; Broad sound; and the North channel, between the Mincarlow rock and the Nundeeps.

ST. MARY SOUND.—The general depths of St. Mary sound are from 6 to 13 fathoms, but the navigation through it to St. Mary road is rendered intricate by the Wetnose shoal, the Round rock, and the Perconger ledge, lying off the western shore; by the Little ledge, the Spanish and Bartholomew ledges, lying in mid-channel; and by the Gilstone, Pollard, and Woolpack rocks off the eastern shore; also the Trisky and Woodcock shoals lying off the north-west shore of St. Mary. The Little ledge, the southernmost of these rocky dangers, was discovered by Capt. Williams, R.N. during his examination of this sound in 1862. It has but 7 feet water on it, and must be carefully avoided by vessels entering from the south-west.

Wetnose Shoal has $3\frac{3}{4}$ fathoms water on it, from which Buzza mill is in line with Raveen rock, bearing N.E. $\frac{1}{4}$ N. Horse point open of Hoe point, W. by S., leads to the southward, and Hangman island in line with Stevel rock N. $\frac{3}{4}$ E. to the eastward; this latter mark leads also eastward of the Round rock, which dries 4 feet at springs.

Perconger Ledge has 7 feet over it. Droptnose rock open of Carn Himbra point, S. by E. $\frac{1}{4}$ E., leads eastward; St. Agnes lighthouse in line with the Cow rock, S.W. by W., leads south-east; and Carn Irishman, on Annet island, open north of the Little Smith rock, W. $\frac{3}{4}$ N., leads northward of the danger.

Little Ledge, of small extent, with only 7 feet over it, lies one-sixth of a mile southward of the Spanish ledge, with Bryer church in line with Little Stevel rock, N. $\frac{1}{4}$ E., and Giants castle just showing clear of south extreme of Carrickstarne rock, E. by N. $\frac{1}{4}$ N. Blue Carn in line with south extreme of Peninnis head, N.E. by E. $\frac{1}{4}$ E., leads $1\frac{1}{2}$ cables to the southward.

Spanish Ledges, two cables in extent, have depths of from one to 3 fathoms on them between rocky heads, which dry at low water springs. The same mark for leading southward of the Little ledge will also lead

south of Spanish ledge, as will also Newfoundland outer rock open of Giants castle, E. by N. $\frac{3}{4}$ N.; the north end of Mincarlo islet in line with west end of Great Minalto rock, N.N.W. $\frac{1}{2}$ W., leads north-eastward; Hangman islet in line with the Stevel rock, N. $\frac{3}{4}$ E., leads westward; and the Cow rock a little open north of Kittern rock, W. by N. $\frac{1}{4}$ N., leads northward.

Bartholomew Ledges.—The 3-fathom boundary of these dangers is upwards of 2 cables in extent, and includes several rocky heads which dry at low water springs. The old mill of Peninnis open south of Wras rock, E. by S. $\frac{1}{2}$ S., leads southward; Dropnose rock open east of Bow rock, S. $\frac{3}{4}$ E. or Castle Bryer islet in line with high-water mark of Shark point (Samson island), N. by W. $\frac{1}{4}$ W., leads eastward; Dropnose rock open west of Bow rock, South, leads westward; and Peninnis old mill in line with the battery on Woolpack point, S.E. by E. $\frac{1}{2}$ E. easterly, leads northward.

Gilstone Rock lies E. by S. half a mile from Peninnis head, and covers at three-quarters flood. To pass southward of it, keep Menewethan islet in line with Newfoundland rocks, N.E. by E. $\frac{1}{4}$ E., until Great Smith rock opens of Peninnis head, W.N.W.

Pollard Rock, lying about 100 feet off the north-west point of Peninnis head, dries 7 feet at low water springs.

Woolpack Rock projects nearly $1\frac{1}{2}$ cables S.S.W. from Woolpack point, and dries a little before low water. An iron beacon with cage, is erected on it.

Trisky and Woodcock Shoals.—Thrisky shoal has $3\frac{1}{2}$ fathoms on it, and Woodcock shoal only 8 feet at low water. Hangman island open west of Nut rock, N. $\frac{1}{2}$ E., leads westward of the Trisky; and the dry mark on St. Martin in line with Greeb rock, N.E. by E. $\frac{3}{4}$ E., leads northwards of both shoals.

DIRECTIONS.—When bound to St. Mary road through St. Mary sound, bring the north-east end of the Mincarlo rock on with the middle of the Great Minalto rock,* N.N.W. $\frac{1}{2}$ W., and it will lead in the fairway between Woolpack rock to the eastward, and Little, Spanish, and Bartholomew ledges to the westward. Peninnis head and Stevel rock are both bold close-to.

Continue with the above mark on until the day-mark on St. Martin comes in line with Greeb rock, N.E. by E. $\frac{3}{4}$ E., then steer direct for the anchorage in St. Mary road. The best position is with Hangman island, its own breadth open northward of Nut rock, and distant from the latter one-third of a mile to the south-eastward, in 4 or 5 fathoms water. If

* See Views on Chart.

intending to moor, place the anchors to the N.W. and S.E. to ensure open hawse with westerly winds.

Broad sound is mostly used by vessels from the south-westward, but is dangerous to such as are not well acquainted with the marks and the set of the tides. Run in between Bishop lighthouse and the Crim rock, but nearer to the lighthouse. The leading mark is Nornour island, its apparent length open northward of Bants Carn point, about E. $\frac{3}{4}$ N.

In proceeding with these marks on, the Gunner, Southward, and Le Jeffry ledges will be left to the northward, and Old Wreck rock to the southward; and after passing these dangers, it will lead direct to St. Mary road, where anchorage may be taken up as before. The Old Wreck is a sunken rock with 3 feet on it, lying about N.N.W., a quarter of a mile from Annet head, and N.W. by W. $\frac{3}{4}$ W. from Great Smith rock.

The North channel is as dangerous as Broad sound to strangers. The best mark is St. Agnes lighthouse, in line with Great Smith rock S.S.E. $\frac{1}{4}$ E. till the leading mark through Broad sound comes on as above.

TIDES.—It is high water, full and change, at the Scilly islands at about 4h. 30m.; equinoctial tides rise 20 feet, ordinary springs 16 feet, and neaps 12 feet. When it blows hard, or has lately done so, from the southward, the tide flows about an hour longer. Northerly winds keep it back in the same proportion.

The tides at about 6 miles southward of the islands appear to set straight, and run for equal spaces of time, to the eastward and westward; but nearer to, and among the islands and rocks, they are subject to a variety of inflections and inequalities.

The flood sets from the S.W. around the islands on their east and west sides, and the two streams meet on the north-east, as indicated by the arrows in the chart.

Through St. Mary sound the tide sets from the southward from half ebb to half flood, and from the northward from half flood to half ebb. The flood sets regularly through St. Mary road from Broad sound, and over Crow bar, through Crow sound, to the eastward; the ebb sets in a contrary direction, but it is not strong.

Through the North channel the flood sets into St. Mary road, and the ebb in the opposite direction.

The tide coming in through Broad sound from the S.W. sets through St. Mary road, towards the east end of St. Martin island, where it meets the tide at 4 hours flood, coming round St. Martin head, which makes the race of Hanjague: this latter prevailing, sets away S.W. by S. as far as Menewethan island, where, meeting Crow sound tide which runs out S.S.E., it makes an extensive race with spring tides, and both go off to the southward together.

In New Grimbsy harbour the tide, at low water, runs in for $1\frac{1}{2}$ hours, then runs out for 3 hours, turns and runs in $4\frac{1}{2}$ hours till it is half ebb; it then turns and runs out the other 3 hours till low water. But between the islands of Samson and Bryer the tide runs in 8 hours from the westward, from low water till 2 hours ebb, and then runs out to the westward till low water.

At half flood, the tide from New Grimbsy harbour sets over the flats, towards St. Mary, until half ebb; and from St. Mary road through New Grimbsy harbour, from half ebb to half flood.

Into Old Grimbsy harbour, St. Helen's pool, and Tean sound, the tide runs 9 hours, from low water to half ebb by the shore; and it sets outward from the same for 3 hours only, that is, from half ebb to low water.

To the S.E. and South of St. Agnes island there is a great rippling or overfall, between 4 hours flood and 2 hours ebb, occasioned by the confluence of the two streams of tide at that period. This overfall is farther augmented by the unevenness of the ground over which the water runs; and sometimes extends as far seaward as 3 miles, but gradually subsides as the tides assimilate.

Thompson Rock.—Many attempts have been made to discover this rock, under almost all circumstances, but without success. It is marked on old charts about 9 miles E. by S. $\frac{1}{2}$ S. from St. Agnes, and is said to have been discovered by Captain Thompson, of the ship *Betty*, which struck on it in the year 1775. Its existence was again reported by the schooner *Isabella* in 1833.*

The SEVEN STONES are a cluster of dangerous rocks, lying nearly in the fairway between Scilly and the Lands End. They are a mile in extent N.N.W. and S.S.E., and are covered at high water. In rough weather the breakers upon them may be seen from a considerable distance.†

The two principal rocks of the cluster are named the Pollard, which appears at half ebb, and the South Stone, which shows at 5 hours ebb. From the Pollard, which is the north-westernmost rock, the day-mark on St. Martin bears W. by S. $\frac{1}{2}$ S. distant 7 miles; the telegraph on St. Mary

* On the 14th of May 1833, the schooner *Isabella*, John Ramsay, master, from Bilbao to Liverpool, steering N.E. with a fresh S.S.W. gale, and a heavy swell from the N.W., passed within 50 yards of a rock, which was seen four times as the sea dipped; it resembled a hay-rick, covered with sea-weed, and had an open cleft down the middle. At this time St. Agnes lighthouse bore W. by N. $\frac{1}{2}$ N. about 10 miles; and, if it was really the lighthouse that was seen, this must have been Thompson Rock: but as the weather was hazy, it is possible that the day-mark on St. Martin was mistaken for the lighthouse, in which case a small error in the bearing would allow it to have been one of the Seven Stones.

† See Admiralty Chart, England, South Coast, Sheet 1, Trevoze Head to the Dodman, with a plan of the Seven Stones, No. 2,565; scale, $m = 0.5$ inches.

W.S.W. $9\frac{1}{2}$ miles ; the Seven Stones light-vessel East nearly 2 miles ; and the Longships lighthouse E. by S. $\frac{3}{4}$ S. 15 miles. The South Stone lies S.S.E. $\frac{3}{4}$ E. two-thirds of a mile from the Pollard.

There are several other sunken rocks in the vicinity of these two, particularly to the northward and eastward of the Pollard, and to the westward of the South Stone ; the former are generally called the Town, and partially appear between the periods of 4 hours ebb and low water ; the latter have no particular name.

The whole of these dangers are steep-to ; there being 38 and 40 fathoms water, at the distance of one mile only, on all sides. The only marks for the position of the Pollard which can be rendered conspicuous or intelligible to a stranger during the day are, the telegraph tower on St. Mary in line with the north-west end of Nornour island, or Bants Carn point open eastward of Carniweather point. The telegraph tower on St. Mary open eastward of the easternmost Carn of Great Granilly islet (it will be also open at the same time eastward of the remarkable conical shaped rock, called Hanjague) will lead half a mile south-eastward of the South Stone and of the rocks near it ; and the telegraph shut in westward of Carniweather point (though its parapet will still appear over the land between the said point and the day-mark), will lead half a mile westward of the Pollard and the rocks in its vicinity.

SEVEN STONES LIGHT-VESSEL is moored in 40 fathoms water, nearly 2 miles East from the Pollard, and $1\frac{3}{4}$ miles E. by N. $\frac{1}{2}$ N. from the South Stone, and as long as she holds fast in that exposed situation there will be no difficulty in the passage between them and the Longships. She carries, on separate masts, two *fixed* white lights, 20 and 38 feet above the sea, and visible in clear weather from a distance of 10 miles. St. Martin's day-mark bears from her about W. by S. $\frac{1}{4}$ S. nearly 9 miles ; the Longships lighthouse E. by S. $\frac{3}{4}$ S. $13\frac{1}{4}$ miles ; and the Wolf rock S.E. by S. $12\frac{3}{4}$ miles. The vessel is painted red, with the word Seven Stones on her sides, carries a ball at each mast head, and a gong is sounded in foggy weather.

In clear weather the objects on the Lands End may denote the position of the Seven Stones ; for instance, the two churches of St. Buryan and Sennen in one will pass over the rocks to the north-eastward of the Pollard.

The WOLF is a half-tidal rock, lying E. by S. $\frac{1}{4}$ S. $20\frac{1}{2}$ miles from St. Agnes lighthouse, S.W. $\frac{1}{3}$ S. $7\frac{3}{4}$ miles from the Longships lighthouse ; and W.N.W. $23\frac{3}{4}$ miles from the lighthouses on the Lizard ; and at low water ordinary springs its length is 180 feet, north and south, its breadth being 130 feet. It uncovers $11\frac{1}{4}$ feet at low water springs, $7\frac{3}{4}$ feet at low water neaps, and is nearly awash at high water neaps. The lighthouse

in course of erection on the rock had attained an elevation of 90 feet above high water in July 1868, and is therefore an admirable beacon during the day.*

The Wolf is steep-to on all sides, and although covered on spring floods, is generally betrayed by breakers, unless during unusually fine weather. There are 34 fathoms within a mile of the rock on all sides, 38 fathoms in the stream of it eastward and westward, and 34 to 37 fathoms between it and the land. The Lizard lights in one, E. by S., will lead southward of the Wolf; but these lights can be seen at this distance only in very clear weather, and from the deck of a vessel somewhat elevated.

DIRECTIONS.—When running up Channel during thick weather, Scilly should not be approached within the depth of 60 fathoms, as in that water the vessel will not be more than 15 miles from the rocks; neither come into less water between Scilly and the Lizard than 44 fathoms, by which precaution the vessel will pass at least 2 miles southward of the stream of the Wolf, the parallel of which cannot be approached, eastward or westward of the rock, so long as that depth is preserved.

When navigating between Scilly and the Lands End, do not run between the Seven Stones and the light-vessel, but pass eastward of her; keeping her westward of North when approaching from the southward, and westward of South when approaching from the northward. From the Wolf the Longships light bears N.E. $\frac{1}{3}$ N., and is distant $7\frac{1}{4}$ miles; be cautious, therefore, when passing it on either side from the southward, or from the northward, not to bring the light on that line of bearing. In thick weather, or during the night, this rock is the more dangerous, as it does not give the warning by sound usually ascribed to it, except on sudden transitions from foul to fair weather, or *vice versâ*.

TIDAL STREAMS.—The following observations on the Tidal streams in the English Channel are condensed from the remarks of the late Admiral Beechy, whose valuable paper, published in the Philosophical Transactions for 1851, and annually reprinted in the Admiralty Tide Tables, has greatly simplified the question of the Channel tides. Hitherto the popular belief has been in a tide and half tide, or, in other words, that the stream runs half a tide longer in mid-channel than it does near the coast; whereas in no part of the Channel does the change of stream differ materially within its fair navigable limits. Both flood and ebb streams turn from one to two hours earlier in the bights of the coast

* A black mooring buoy is laid down about two-thirds of a mile E. by N. from the Wolf, at which the vessel employed as a tender to the works now in progress on the rock is occasionally moored. The mariner is cautioned to keep clear of this vessel, from which a white light is exhibited during the night.

than in the offing, of which fact vessels take advantage when turning to windward.*

These observations show that the two Channel streams, viz., the one contained between the west end of Dover strait, and a line joining the Start and the Gulf of St. Malo, and the other between the east end of Dover strait and a line joining the estuary of Lynn and the Texel, run in opposite directions at the same time, both setting uniformly in a direction *towards* Dover while the water is *rising* at that place, and *away* from it while the water is *falling*. Also that these streams run in opposite directions to the streams outside them, viz., the stream at the mouth of the Channel, and the stream in the North Sea, and that where they meet, the tide is ever varying its direction, according as the strength of one stream prevails over that of the other, producing a rotary motion with scarcely any interval of slack water.

As the Channel streams are always running in opposite directions, there is necessarily a point where they meet and separate, and this occurs in Dover strait, or in the space between a line drawn from Beechy head to the river Somme, and a line from the North Foreland to Dunkerque. But in this straight, the stream, although it obeys first one Channel stream and then the other, does not slack with them, but is found to be still running at high and low water on the shore, at which times those streams are at rest, so that the strait of Dover never has slack water throughout its whole extent at any one time; this in consequence is called an intermediate tide.

Off the mouth of the Channel the stream, although materially influenced by the indraft and outset of the Channel, will be found running to the northward and eastward, while the water is falling at Dover; and to the southward and westward while it is rising at that port. The particular direction and rate of the streams at every hour of the tide at Dover are given in the table in page 252, and it is only necessary to mention here, that to the southward of the parallel of Scilly, the tides of the Channel and offing blend together with varying force and direction, and occasion the stream to be constantly changing, and in some places even to make the entire circuit of the compass in one tide, never remaining long upon any one point, so that any written description of their course is rendered very difficult, and the Table alone must be consulted.

In the space between a line joining the Lands End and Ushant, and a line joining the Start and Casquets, there is a mixed tide, partaking of the joint directions of the Channel and offing streams. To the eastward

* For direction and rate of the Tidal Streams in the Channel, see Table, page 252.

of the latter line the stream follows the fairway of the Channel, and will carry a vessel towards Beechy head while the water is rising at Dover, and away from it while it is falling.

The gulf of St. Malo, from its high and strong tides, exercises a powerful influence over the navigation of that part of the Channel in its immediate vicinity, and the seaman must be especially on his guard when drawing near this locality. With a falling water at Dover the stream sets sharply into this Gulf on both sides of the Channel islands, which the prevalence of westerly winds is said to increase ; but with a rising water at Dover it sets across and out of the Gulf, the north-eastern part of the stream sweeping round the Casquets towards Alderney, and through the Russel and other channels about Guernsey, towards Alderney race.

On the south side of the Channel, with a rising water at Dover, the stream sets sharply round cape Barfleur into the Baie de la Seine, curving more and more with the bight of the bay until it finally takes the sweep of the shore. With the flood tide the western half of the bay is partly in eddy, and the tide slacks in all that part nearly an hour before high water at Dover, whilst in the eastern half of the bay it runs about half an hour longer than at Dover, so that here a ship beating up Channel towards the end of a rising tide at Dover, may prolong the tide in her favour by standing close over to the French coast eastward of Havre.

On approaching Boulogne, however, at the beginning of a rising tide, great attention should be paid to the direction of the stream given in the Table, as the streams hereabout meet and are turned down upon the French coast, so that a ship, which on the English side would at this time have a stream setting straight up Channel, here encounters one upon her beam, sweeping her down towards the entrance of the river Somme, and hence probably the cause of some of the many disastrous losses which have occurred in this part of the Channel.

• In Dover strait, as before observed, the Channel streams meet while the water is rising at Dover, and separate while it is falling there. The point of union and separation is not, however, stationary, but moves from west to east between Beachy head and the North Foreland, a distance of 60 miles, both on the rising and falling tide. When the water at Dover begins to fall, the separation begins off Beachy head. As the fall continues, this line creeps to the eastward ; at two hours after high water it has reached Hastings ; at three hours Rye ; and thus it travels on until at low water by the shore, it has reached the line extending from the North Foreland to Dunkerque. At this time the Channel streams, eastward and westward of Dover strait, have ceased running, and it is slack water ; but the intermediate tide in the strait is still running to the westward.

When the water at Dover begins to rise, the Channel streams have made and both set towards Dover; that eastward of the strait consequently goes with the intermediate tide, which has not ceased running to the westward, while that westward of the strait meets it, and this opposition continues throughout the rising water at Dover. The point of meeting begins off Beachy head at low water, and gradually shifts its position eastward as the water rises by the shore; the meeting of four hours before high water is nearly the same as the separation at two hours after high water; and so moves on during the subsequent hours, till about the time of high water at Dover the point of junction has reached the North Foreland, and the Channel streams have ceased running, leaving the intermediate tide in the strait still pursuing its course to the eastward. Within the next hour the Channel streams have made, east and west, so that now the intermediate tide falls in with the stream eastward of the strait, and travels with it, whilst it separates from that westward of the strait, dividing at Beachy head, as at first.*

WINDS.—The prevailing winds in the Channel are those from the western quarter, which generally blow during two-thirds of the year. Gales from the westward are felt in all seasons, but from November to March inclusive they are most frequent, and generally last three or four days. Of these, a S.W. gale is considered the most dangerous in the eastern part of the Channel, for when accompanied by rain it blows in violent gusts, and sometimes suddenly changes its direction to N.W., North, and even to N.E., without losing its strength, and causing in a few hours, a heavy sea upon the French coast to the southward of cape Gris-Nez. If the wind remains fixed in either of the latter points, and its force moderates, the weather becomes fine; but should it back round to the S.W., bad weather is sure to return. It has been generally remarked that those gales which occur during spring tides are more violent and last longer than those which take place during the neaps, and that it is at the beginning of the flood that they acquire their greatest strength.

Gales from North to N.E. are also violent, but they usually last only from 24 to 36 hours, and the wind does not shift as it does with those from the westward. They cause a heavy sea on the flood stream, and during their continuance the land is generally covered with a white fog, which has the appearance of smoke. This is also the case with all easterly winds, which are sometimes of long duration, and blow with great force.

When S.E. winds are accompanied by rain they are often violent, and

* For the Inshore Streams, see page 133.

almost always turn into gales, during which the wind in the squalls flies quickly round to N.E., and sometimes to North and N.W., making it dangerous to be upon the French coast when these unexpected changes take place. If it remains fixed in either of the latter points, and moderates, the weather is soon re-established, but should it return to the S.E. or South, the bad weather will continue.

Moderate winds from N.W. to N.E. bring fine weather. In the summer the N.E. winds blow more particularly in the afternoon. In the morning there is a light breeze from the S.E., but towards noon it changes to N.E. and freshens; towards the evening it decreases; at night a calm ensues, and the cool air condenses the vapours. When this condensation does not take place, it is a sign of a change of wind.

Calms are of rare occurrence, and do not last long, except in summer. When they occur during winter, it is regarded as the precursor of bad weather. The most certain indications of bad weather are, swell in the offing during a calm, and surf on the coast.

In wet winters snow is abundant, and when it blows, the wind continually changes its direction, and the snow, which whirls and obscures the air, prevents the land from being seen. During the intervals of these snow showers, there is often great difficulty in recognizing the coast which may be in sight, as the snow completely changes its appearance.

The greatest quantity of hail falls during the months of March and April. These hail showers cause sudden changes in the direction of the wind, and are consequently dangerous to sailing vessels navigating near the shore.

FOGS and MIRAGE.—Fogs are frequent in all parts of the Channel, and they are formed both on the English and French coasts, in the valleys and low marshy lands, whence the winds drive them out to sea. In summer, they only hide the land in the morning, as they are readily dispersed by heat or a light breeze; but the moist haze, driven in by westerly winds from the sea, is more tenacious, and only yields to strong winds. This haze always causes a short sea, and frequently turning to rain, brings bad weather.

In the eastern part of the channel, it is rare for the land to be completely free from vapours, unless previous to strong N.E. winds, when it may be distinctly seen from a great distance. The winds from the western quarter, as has been remarked, bring thick clouds, which frequently hide the land; and when it blows strong from the eastward, the vapours which cover the land are dense in proportion as the wind is strong and lasting.

Mirage is frequent on the French coast during the season of fine weather and is considered an indication of fine weather, when it only tends to enlarge the apparent size of objects; but at all seasons when it distorts

them, so as to render them difficult of recognition, it is deemed to be a sign of rain, or strong easterly winds.

VARIATION of the COMPASS.—The amount, for 1869, at the entrance to the channel, and off the principal headlands of the English coast, will be found at the head of each chapter. The present general direction of the lines of equal variation is S.S.W. and N.N.E. (*true*), or nearly at right angles to the channel courses. Thus from a position in the meridian of cape Clear to the Downs, a distance of only 425 miles, the variation changes nearly 6° , or more than half a point ($25^{\circ} 15'$ to $19^{\circ} 20' W.$), and therefore strict attention should be paid to make the necessary corrections to the courses for the successive changes, in proceeding up or down Channel, especially when steaming or sailing at a high rate of speed.

As it may be useful for the correction of charts of an early date, and also denotes the nature of the changes of the variation within a recent period, the amount at Greenwich, and its vicinity, for every successive 10 years of the present century is herewith given:—

1800	-	-	⁰ 24 4 W.	1840	-	-	⁰ 23 23 W.
1810	-	-	24 14 W.	1850	-	-	22 24 W.
* 1820	-	-	24 11 W.	1860	-	-	21 15 W.
1830	-	-	24 2 W.	Present annual decrease 7'.			

* In 1818 the maximum Westerly variation of $24^{\circ} 27'$ appears to have been attained.

CHAPTER II.

TREVOSE HEAD TO THE LIZARD.

 VARIATION IN 1869.

Trevoze head	-	-	23° 25' W.	Runnel-stone	-	-	22° 30' W.
Longships	-	-	22° 40' W.	Mounts Bay	-	-	28° 55' W.

TREVOSE HEAD.—Allusion has already been made to the fact (page 5) that Trevoze head is one of the best landfalls to make when bound from the westward towards the Bristol channel. When first seen it appears as a round island, and may be further known on nearing the land by the white lighthouse, 87 feet high, on its north-western part, and by the Quies rocks, lying a mile westward of it. A rocket apparatus is kept at Trevoze farm in case of shipwreck.*

LIGHTS.—The lighthouse on Trevoze head exhibits two *fixed* white lights of the first order; the lower light is 50 feet in advance of the higher light, and 129 feet above the level of high water; the upper light is 204 feet above that level. The lights may be seen in clear weather from the respective distances of 17 and 20 miles.

The Quies are a cluster of rocks above water, at a distance of nine-tenths of a mile W.N.W. from Dinas point, the western horn of Trevoze head. These rocks are upwards of one-third of a mile in extent, and though between them and the Moor Quie—another mass of rock close to Dinas point—there is a deep water channel half a mile wide, it should never be used save in cases of necessity.

The COAST.—From Trevoze head to Towan head the distance is 8 miles S.W. $\frac{1}{4}$ S., the intervening shore, which falls back $1\frac{3}{4}$ miles, being high, precipitous, and indented. Park head lies S.S.W. $\frac{1}{4}$ W. 3 miles from Trevoze head, and is foul for a distance of three cables from the shore. In the bay between Park head and Towan head there are two inlets, the one is called Mawgan Porth, the other the Porth. Mawgan Porth, at $3\frac{1}{2}$ miles E.N.E. of Towan head, is shoal at its mouth, and open to seaward. The Porth, at $1\frac{1}{2}$ miles eastward of the head, is also

* See Admiralty Chart, England, South Coast, Sheet 1, Trevoze Head to Dodman Point, No. 2,565; scale, $m = 0.5$ of an inch.

open to the westward, and dries at low water ; it is, however, frequented by small vessels to unload coal. The tall square tower of St. Eval church, which stands about 2 miles to the south-eastward of Park head, is a prominent object on the outline at the back of the coast in this locality.

NEW QUAY HARBOUR.—Towan or New Quay bay is immediately to the eastward of Towan head, and in its south-western part is the tidal harbour of New Quay formed by two piers, the southern of which runs out N.N.E. $\frac{1}{2}$ E. 137 yards, and the northern pier S.E. 61 yards. On the southern pier-head stands a tower with a flag-staff, and on the northern pier there is a crane capable of lifting 2 or 3 tons. The little town of New Quay is a rising watering place, and the pilchard fishery is pursued on a considerable scale.

The harbour, about $3\frac{1}{4}$ acres in area, is frequented by vessels of about 13 feet draught. The bar has 16 feet water on it with a 21 feet tide, and 10 with neaps of 15 feet, but the depth occasionally varies, for with a continuance of north-easterly gales, the sand is carried out of the harbour to the depth of 2 feet, and it again accumulates in moderate weather.

The entrance is 80 feet wide, and open to the south-eastward ; but during northerly gales a heavy sea sets in, which causes the vessels lying on the south-eastern side of the harbour, with stern ropes made fast to the northern pier, to strike hard on the sandy bottom. The harbour should not be run for, with a ground swell on, or with gales blowing on the land, for off the entrance, and for some distance outside, the sea breaks heavily. Water can be obtained in abundance from a spring in the cliff.

Life Boat.—A life boat is stationed at New Quay ; also a rocket apparatus in case of shipwreck.

The COAST.—From Towan head the coast, deeply indented, extends 2 miles W. by S. to the north point of Holywell bay, marked by a rock above water named the Chick, off which is a sunken danger with 16 feet water ; and thence to St. Agnes head the distance is $6\frac{1}{3}$ miles S.W. by W. Between Towan head and Holywell bay is a creek named the Gunnel, which is capable of receiving small coasters at spring tides only ; its outlet lies between West and East Pentire points, the channel being close to the latter. Off Penhale point, on the south side of Holywell bay, is Carter's rock, which makes like a double pyramid when seen from the westward.

From St. Agnes head to the tidal harbour of Portreath, a distance of 4 miles in a south-westerly direction, the cliffs vary from 200 to 150 feet in height ; but thence to Godrevy island, another 4 miles, the cliffs are about 250 feet high.

Buoy.—Formerly, large floating beacons were moored off the north side of the Stortes, but as frequently broke adrift. These dangers are now marked by a black buoy in 10 fathoms, N.N.W. $\frac{1}{4}$ W., $1\frac{1}{4}$ miles from Godrevy island lighthouse; but as it is frequently washed away, no reliance should be placed on its being in position.

Ceres and Bessack Rocks.—About a mile south-west of Godrevy head, on the eastern shore of the bay, at low water mark, is Ceres rock, which covers at two-thirds flood; and N.N.W. of it, nearly half a mile from high-water mark, is Bessack rock, which covers at a third flood. Lelant church just open of Black cliff, S.W. $\frac{1}{2}$ W., leads north of the Bessack in 6 fathoms water.

HAYLE ESTUARY.—From Godrevy head to the mouth of the river Gwythian, which flows into the sea at 6 cables to the southward, the eastern shore of St. Ives bay gradually slopes, and masses of rugged rock project off to low-water mark; and thence a long range of the Phillack towans or sandhills, 100 to 150 feet in height and covered with bent grass, extends to the entrance of the Hayle estuary. The beach, of fine sand and shell, runs out to the distance of 2 cables, but its level is continually altered by gales of wind.

The Hayle estuary is formed by the confluence of several small streams, which take their rise some distance inland. On the western side of the entrance a half tide dike, 8 to 12 feet above low water springs, runs out 643 yards in a northerly direction from Chapel Anjou point, having five perches, or warping posts, erected on it, and two black buoys to mark the continuation of the sand bank. The eastern side of the channel is marked by red buoys; the outer one being a can buoy, and the rest square shaped with rings for warping. The black nun buoy on the bar has no distinguishing mark on it.

A flag is hoisted near the Ferry house on the arrival of steamers trading to the port, when there is sufficient water for them to cross the bar, which has 19 feet on it at high water ordinary springs, and 13 feet at neaps. There are from 20 to 17 feet in the river off Hayle at high water springs, and 14 to 11 feet at neaps. A graving dock at Hayle can admit a vessel 250 feet long and 14 feet draft at high water ordinary springs; there are also sheers for lifting boilers, and foundries noted throughout the west of England for producing the largest description of steam engines, and pumping gear, for the mines.

Supplies of provisions, water, and marine stores are readily obtainable at Hayle, which was made an independent port in 1864, with St. Ives attached to it as a creek. The foreign and coasting trade at Hayle is very considerable, and the harbour affords excellent shelter for vessels. A steam

tug is stationed at the port to assist vessels in and out of harbour. In 1866 there belonged to the port 27 sailing vessels, representing 3,454 tons, and two steamers.

LIGHTS.—Upon the rising ground on the western side of the entrance of Hayle estuary, and 217 yards within Chapel Anjou point, are two wooden lighthouses, each exhibiting a *fixed* white light, only when there is a depth of 12 feet water over the bar. The high lighthouse, painted red, stands on a tripod; and the low lighthouse, near the edge of the cliff, is placed on four legs, and painted black. The lights are elevated 81 and 59 feet respectively above high water, and in clear weather should be seen from a distance of 6 miles. They are 99 yards apart, and when in one S.S.W. $\frac{1}{4}$ W. lead through the best part of the channel.

Life Boat.—A life boat, and rocket apparatus, are stationed near the Custom-house, on the eastern side of the harbour.

ST. IVES HARBOUR.—From Hayle to Battery point, or St. Ives head, the coast is composed of bold rocky cliffs, varied by three sandy bights. The summit of St. Ives head is 104 feet above high water.

Very little of the town is visible until St. Ives head has been rounded, and then the most prominent objects are the square tower of the church, 90 feet high, and some terraces on the high ground. The town is backed by several hilly summits, on one of which, amongst wood, is Tregenna castle, the seat of the proprietor, and on another is Knill's monument, an obelisk whose base is 545 feet high; whilst more to the south-eastward it the rugged summit of Trecrobben hill, 590 feet high.

At a quarter of a mile southward of the head is the tidal harbour and town of St. Ives, celebrated for its pilchard fishery. The harbour is formed by a pier, built in 1770 by Smeaton, running out S. by W. $\frac{1}{2}$ W., and then S.W., the whole length being 166 yards. In 1857 a wooden pier was erected, projecting with a curve from the inner end of the stone one, and running out 207 yards in a S.E. by S. direction.

The bottom of the harbour is composed of fine sand and shingle, which dries 7 feet; there are two buoys with rings attached, for the purpose of making fast bow moorings; but on account of the ground swell, which is severely felt on this part of the coast, and the pier affording such limited shelter, it is sometimes difficult to secure vessels. There are 14 feet in the harbour at high water ordinary springs, and 8 feet at neaps. The low water edge of sand extends from the end of the pier to Pednolver point. Supplies in moderate quantities can always be obtained at St. Ives; water is good and plentiful, and can be procured by hose from several places round the harbour.

The principal imports are corn, timber, and coals; and the exports copper

ore and fish. In 1866 there belonged to the port 148 sailing vessels representing 4,973 tons. In 1867 there were entered inwards 161 vessels of 11,780 tons, and outwards 36 vessels representing 3,340 tons. In the same year 226 vessels of 20,545 tons entered the harbour for shelter. There were also 470 boats, from 15 tons and under, employed in the mackerel, pilchard, and other fisheries. In 1861 the population amounted to 7,027, many of whom find employment in the neighbouring mines, but their principal support is derived from the pilchard fishery: the fish are sometimes taken in immense quantities, and are generally exported in a cured state to the Italian market.

LIGHTS.—At the end of the outer wooden pier at St. Ives, a small fixed red light—visible 2 miles only—is shewn all night. A stone lighthouse, 36 feet from the end of the inner pier, exhibits—at an elevation of 23 feet above high water—a fixed white light, from the 1st September to 30th April, when there is a depth of 10 feet at the head of the inner pier; the light should be seen in clear weather from a distance of 9 miles, but there is a difficulty in distinguishing it from the lights of the town.

Life Boat.—A life boat is stationed at St. Ives, and a rocket apparatus is in readiness in case of shipwreck.

TIDES.—It is high water, at full and change, at St. Ives, at 4h. 44m.; springs rise 21 feet, and neaps 15 feet.

DIRECTIONS.—There is no difficulty in entering St. Ives harbour with a leading wind, but it should not be attempted with a ground swell on, or with gales from seaward. When Merran rock (a detached mass between Battery point and outer pier) is covered, there is a depth of 12 feet into the harbour. The Hoe rock, off Battery point, as well as the Merran rock—when covered—may be cleared by keeping Knill's monument open to the eastward of the outer pier.

ANCHORAGE.—Small vessels lie aground at low water in St. Ives harbour, secure from all winds, but vessels of burthen anchor in the bay. The best position is in 9 fathoms, with Battery point N.W. $\frac{1}{4}$ W., and Pednolver point W. $\frac{1}{4}$ S.; the bay, however, is completely exposed to northerly winds, which tumble in a heavy sea.

Bann Shoal is a narrow rocky ridge, about three-quarters of a mile in extent, N.N.E. and S.S.W., with irregular depths from 8 to 20 fathoms on it. From the least water, 8 fathoms, St. Ives head, or Battery point, bears S.E. by S., and is distant $12\frac{1}{2}$ miles; and Sennen church, in line with the extreme of the high-water mark at cape Cornwall, S. by W. $\frac{1}{4}$ W., 12 miles.

Cape Cornwall Bank, lying S.W. $\frac{1}{2}$ W. 6 miles from Bann shoal, is a narrow ridge about 3 miles long, N.N.E. and S.S.W., the known

depths on it varying from 13 to 20 fathoms ; but according to Captain Sheringham, it is deemed probable that on one spot near the north end, the depth is less than 10 fathoms.

CAUTION.—As the sea breaks heavily in bad weather on both of the above shoals, particularly during north-west gales, their locality should at that time be avoided, especially by small and heavily laden vessels. The coast being so far distant, no good marks can be given for clearing them ; but in proceeding round the Lands End to the northward, if the weather be clear, the Longships lighthouse kept on a S. $\frac{1}{4}$ E. bearing, will lead a mile westward of cape Cornwall bank ; the Brisons islets S. by W., or at night the Longships light dipping and bearing S. by W. $\frac{1}{2}$ W., will lead between the shoals ; and cape Cornwall S.S.W. will lead a mile eastward of Bann shoal.

The COAST from St. Ives head curves round to the west and south-west to cape Cornwall, which is distant about 11 miles. From St. Ives to Gurnards head the shore is rugged and indented, the height of the cliffs averaging about 250 feet. To the westward of Carnmen point is a mass of rocks called the Caraks,* the largest of which rises 25 feet above high water ; the rest cover at a quarter flood : the outermost rock lies N. by W. $\frac{1}{4}$ W. 2 cables off shore. From the Caraks, the outermost of the Carlow rocks bears W. by S. $\frac{3}{4}$ S. distant three-quarters of a mile, and is $2\frac{1}{2}$ cables off shore ; it covers at three-quarters flood.

Gurnards head, 185 feet above high water, is rugged and steep, and surrounded by a mass of detached rocks, the largest of which, named the Ebal, lies North nearly a cable from the head, and covers at high water springs ; thence to the Wra or Three Stone Oar rocks, which bear W. $\frac{1}{4}$ S. 3 miles, the cliffs vary from 50 to 100 feet in height. A patch called the Carnellosh shoal, with $3\frac{1}{2}$ fathoms on it, lies eastward of Gurnards head, with the north extreme of the Ebal rock bearing W. $\frac{1}{2}$ S., and the northern house of Trereen farm in line with the Old Mine chimney, S.S.W. $\frac{1}{2}$ W. There is also a small rock, with only 6 feet water over it, called the Carnellosh, lying a cable S.E. by E. of this patch.

From Gurnards head to Greeb point the coast should not be approached within a third of a mile, for a small rock, which uncovers only a foot at low water springs, lies W.S.W., three-quarters of a mile from the Ebal rock, and about 2 cables off shore ; and a ledge of rocks extends in a north-easterly direction upwards of a cable from Greeb point. The Mozen rocks lie off Pendeen cove, in an E.N.E. direction, and cover at a quarter flood. Their northern extremity bears S.E. by E. $\frac{1}{2}$ E., half a mile

* Carak, carrey, carrack or carrick is the Celtic name for rock.

from the Three Stone Cove. A rather important spring is found in Pealpen Cove in case of emergency.

The Three Stone Cove beach is a third of a mile to the north-eastward of Watch Hill point, and in low water is ordinary springs. The passage between them and the point should not be interrupted by a stranger. The three rocks called the *Stumpstones* lie $\frac{1}{2}$ cables off shore in a north-westerly direction from Watch Hill point. The two inner rocks cover at two-thirds flood, and the outer one is awash at low water. The *Arctick rock* bears S.W. by W. three quarters of a mile from the inner Three Stone Cove and covers at half tide. The *Manner rock* covers at half flood, and lies two-thirds of a cable from Boulderback head; and the Cove is *Manny rock*, which resembles a boat turned upside down. It is a cable's length in a northerly direction from the head, and also covers at half tide.

The crags from Watch Hill point to Cape Cornwall are about 300 feet high, and deeply indented; the cliffs vary from 50 to 100 feet in height, and many of the points at a distance appear like islands. The cliffs from the Cape to the Gwyther sands are from 35 to 25 feet high, after which they rise to 150 feet at Crampers point, and then average about 300 feet to Peal point. Off Cape Cornwall, a third of a mile in a N.N.W. $\frac{1}{2}$ W. direction, are a group of detached rocks called the *Vynecks*, which cover at a quarter flood, and lie with the Longships lighthouse touching the eastern shoulder of the smaller of the *Brisons*, S.W. $\frac{1}{4}$ S.

The *Brisons* are two rocky islets 90 and 71 feet respectively above high water, lying W. $\frac{1}{2}$ S. half a mile from Cape Cornwall, and N.E. $\frac{1}{4}$ N. $3\frac{1}{2}$ miles from the Longships lighthouse. Between them and Pel Pry point are various rocky ledges which cover at a quarter flood, and shoal water extends nearly a cable's length S.W. by W. $\frac{1}{2}$ W. from the lower islet; and at the same distance W. $\frac{1}{2}$ N. is a small patch of only 16 feet. The two *Brisons* in one N. by E., leads westward of the Outer Greeb patch, lying south of the islets; and Nanjulean mill open in the valley, S.E. $\frac{1}{4}$ E. leads to the southward.

WHITESAND BAY is between Cape Cornwall and the Lands End, and in the middle of it is Boulder rock with $3\frac{1}{2}$ fathoms over it, from which Mathews house is in line with Sennen church, bearing S. by W. Vessels will ride well sheltered from easterly winds in 12 to 15 fathoms outside this rock, about two-thirds of a mile off shore, with Cape Cornwall N.N.E. $\frac{1}{4}$ E.; but the danger arising from westerly winds makes this bay little frequented.

Sennen Cove is in the southern part of Whitesand bay, within Padon Mound point, and the seine boats are protected by the rocks without, called the *Bo Collos* and *Bo Col*, which are awash at high water.

springs. The Little Bo or outermost rock covers at half flood, and lies nearly a third of a mile from the shore, with the point bearing S. $\frac{3}{4}$ W.

Life Boat.—A life boat is kept in Sennen cove, which is a coast-guard station; there is also a rocket apparatus in readiness in case of shipwreck.

The LANDS END, or western extreme of England, may be seen in clear weather from a distance of 8 or 9 leagues; and when first viewed from the south-westward and southward has the appearance of two detached hummocks. On nearing the land another hummock, with buildings on it, will appear to the westward; then cape Cornwall will appear above the horizon, and ultimately the whole will form a continuous line of coast. The most conspicuous buildings in the vicinity of the Lands End are, the churches of St. Buryan and Sennen, the former being elevated 488 feet, and the latter 358 feet above high water.*

From Peal point, which is the north-western extreme of the Lands End, the coast trends S. by E. $2\frac{1}{4}$ miles to Guethensbras point, and the cliffs range in height from 150 to 200 feet. At $3\frac{1}{2}$ cables S. by W. $\frac{1}{2}$ W. from Peal point is the Armed Knight islet, 88 feet above high water; and N.W. $\frac{1}{2}$ N., upwards of a cable from Peal point, are the Peal rocks, awash at low water. A patch of 2 fathoms lies $1\frac{1}{2}$ cables to the north-westward of the Armed Knight, and off all the intervening points to Guethensbras are a number of outlying rocks extending about half a cable off shore, and covering from a quarter to half flood.

TIDES.—It is high water, full and change at the Lands End at 4h. 15m.; springs rise 22 feet 7 inches; neaps 16 feet 8 inches.

LONGSHIPS ROCKS and LIGHT.—About 3 miles N.N.W. $\frac{1}{2}$ W. from Tol Peden Penwith, or the south-eastern extreme of the Lands End, and a mile W.N.W. from Peal point, is a group of high detached rocks called the Longships, on the largest and most elevated of which stands a lighthouse, from which the Brisons bear N.E. $\frac{1}{4}$ N. $3\frac{1}{4}$ miles; the Runnel-stone, S.S.E. nearly 4 miles; the Wolf rock, S.W. $\frac{1}{3}$ S. $7\frac{1}{2}$ miles; and St. Agnes lighthouse, West $25\frac{1}{2}$ miles. The summit of the lighthouse rock is 44 feet above high water ordinary springs, and from it a ledge extends S.S.E. $\frac{1}{2}$ E. nearly half a mile. The other rocks vary from 44 to 20 feet in height.

At the distance of two-thirds of a mile N.E. by E. $\frac{1}{2}$ E. from the lighthouse lies Sharks Fin rock, which covers at two-thirds flood, and is steep-to, except off its western side, where a shoal, with only 9 feet on it, projects off a third of a cable. A rocky shoal called the Ketel Boton lies E. by S. $\frac{1}{4}$ S. two-thirds of a mile from the lighthouse, and covers at three-quarters flood; shoal water extends a quarter of a mile in a S.W. $\frac{1}{2}$ S. direction from its highest part. Between the Ketel Boton and Sharks Fin is a

* See Admiralty Plan of Longships, No. 2,473; scale, $m = 6$ inches.

small rock named the Fe-les, which covers at a quarter flood, and has deep water around it.

The Longships lighthouse, 51 feet high, and coloured white, exhibits, at 79 feet above the level of high water, a *fixed* white light, visible in clear weather from a distance of 14 miles.

DIRECTIONS.—Vessels bound round the Lands End from the eastward will open the Longships light of Tol Peden Penwith when it bears N.N.W. $\frac{1}{4}$ W., and by steering for it on a N. $\frac{1}{2}$ W. bearing they will clear the Runnel-stone. The Longships may, if requisite, be passed at the distance of 2 cables, as the westernmost rock does not lie more than half that distance from the lighthouse.

Approaching the Longships from the south-westward, be careful to keep the light out of a N.E. $\frac{1}{4}$ N. line of bearing to avoid the Wolf rock. Having rounded the Longships, and bound to the north-eastward, by not bringing the light to the westward of S.S.W. $\frac{1}{4}$ W., it will lead about a mile westward of the Brisons.

There is a good channel nearly half a mile wide inside the Longships, between the Ketel Boton and Peal Point. It carries 8 to 11 fathoms water, but is seldom used except by coasters. The leading mark through is the highest part of the northern Brison appearing westward of the highest part of the southern or lower Brison, N.N.E. $\frac{1}{4}$ E.

Carn Base.—The soundings are irregular from two to three miles S.S.W. $\frac{3}{4}$ W. from the Longships lighthouse, and $2\frac{1}{4}$ miles in that direction, and the same distance off shore, is a rocky patch of 9 fathoms, named the Carn Base, from which Chapel Carn Brea is just open eastward of Sennen church W.S.W.

RUNNEL-STONE.—The two beacons erected at Porthgwarrah near Tol Peden Penwith, when in one, bearing N. by E. $\frac{1}{2}$ E., point to a rock called the Runnel-stone, which lies three-quarters of a mile from the land, and covers at two-thirds flood. The southernmost or outer beacon is of a conical form, and painted red; the inner or northernmost has a large extended base, and is coloured black, excepting a small part of the pillar immediately above the base, which is white.*

The rocks in the vicinity of the Runnel-stone are as follows:—The Lee Mean, awash at low water, lies S.E. by E. $\frac{3}{4}$ E. distant half a cable; and the Carn-stone, with 8 feet over it, N.W. by N. a cable's length from the Runnel-stone. A rocky patch called the Lee Ore, with 11 feet over it, lies 4 cables N.E. $\frac{1}{4}$ E. from the Runnel-stone, directly in the middle of the passage between it and the coast, with the Longships lighthouse appearing

* See Plan of Runnel-stone, with dangers in its vicinity, No. 2,473; scale, $m = 6$ inches.

just open of Guethensbras high water point, N.N.W. $\frac{1}{2}$ W., and a slated shed in line with Peden-mean-anmear cliff, E. by N. $\frac{1}{4}$ N. A rocky ledge of uneven ground, named the Poldew, with 4 fathoms on it, and 8 to 13 fathoms close-to, lies W.N.W. 3 cables from the Runnel-stone.

Bell Buoy.—A black bell buoy bearing a staff and ball is moored in 16 fathoms water, about 70 yards S.W. $\frac{1}{2}$ W. of the Runnel-stone, with the beacons N. by E., and the Longships lighthouse N.N.W.; no dependence, however, can be placed on the buoy remaining in its position, for it often breaks adrift.

DIRECTIONS.—To pass between the Lee Ore and the Runnel-stone, bring the Longships lighthouse well open of Guethensbras point, N.W.N. $\frac{1}{4}$ W., and when St. Levan church opens of the land, the vessel will be south-west of all danger in the vicinity of the Runnel-stone; the passage, however, between this rock and the land should never be attempted by a stranger. Godolphin hill in line with Carndu point bearing E. $\frac{1}{2}$ N. leads about two-thirds of a mile south-east of the Runnel-stone; at night, as before stated, the Longships light N. $\frac{1}{2}$ W. leads nearly a mile to the westward.

The COAST from Guethensbras point bends round to the eastward, and then runs in an E. $\frac{1}{2}$ S. direction 5 miles to Carndu point. At the distance of 2 miles is Castle Treveen point rock; the cliffs between are 200 to 250 feet high, and the shore forms a number of little inlets. Off Guethensbras point the low water rocks extend W. $\frac{3}{4}$ S. nearly 2 cables, the outermost covering at a quarter flood; thence the low water rock lying a cable's length off Tol Peden Penwith, bears S.E. a third of a mile. At the distance of 2 cables S.E. by E. $\frac{3}{4}$ E. from Ella point, is a rock with only 6 feet on it; and at a third of a cable southward of the point is another rock awash at low water. To the eastward of the point there is a bight called Porthgwarrah cove, and off its eastern point, which is the western limit of Por-chapel bay, a ledge of rocks extends S. $\frac{1}{2}$ E. nearly a cable's length. A rock also lies S.W., half a cable from Peden-mean-anmear point.

Between Castle Treveen and Tetterdu points, the cliff ranges from 100 to 150 feet in height, with the exception of the low rocky shore of St. Loy cove, the western extreme of which is Merthen point. In a S.W. $\frac{1}{4}$ W. direction from Castle Treveen point are two detached rocks, but the outermost is only a cable off shore; and to the eastward is the high water rock, called the Seghys. Penberth cove, which is used as a fishing station, is half a mile eastward of Castle Treveen point. From Merthen point the low water rocks extend upwards of a cable off shore, and West half a mile from Tetterdu point is the Tregiftian rock with only 4 feet water on it; Carndu point open of Tetterdu point, bearing E. $\frac{1}{2}$ N., leads south of it.

From Tetterdu point, which slopes gradually to cliffs not more than 50 feet in height, to the southern side of Lamorna cove, the land rises abruptly, the cliffs varying from 60 to 80 feet in height, and from 80 to 100 feet on the northern side of the Cove to Carndu point, which is only 44 feet high. At nearly 2 cables eastward of Tetterdu point, and at about the same distance off shore, are the Buck rocks, which cover at three quarters flood. The Gull rock, lying off Carndu point, is precipitous, and 80 feet above high water; half a cable W.S.W. of it is a small rock called the Haver, which covers at a quarter flood.

From Carndu point the cliffs decrease in height, varying from 50 to 40 feet, until near Flat point, which is only 20 feet high, when they gradually rise to 60 and 90 feet to Penzer point, which is abrupt; and thence to Mousehole they range from 30 to 40 feet, the high land sloping directly to them. At nearly 2 cables eastward of Carndu point, and about half that distance southward of Flat point, is the Lelland rock, which covers at a quarter flood.

MOUNTS BAY is between the Runnel-stone and Lizard point, which are distant from each other $18\frac{1}{2}$ miles, in a N.W. $\frac{3}{4}$ W. and S.E. $\frac{3}{4}$ E. direction. This spacious bay receives its name from the remarkable and picturesque isle, Mount St. Michael, lying at its head; the mount is of a conical form, 263 feet high, and about a mile in circumference, and bears a striking resemblance to the mount of the same name in Normandy. The inner points of the bay are Carndu to the westward and Cuddan to the eastward, bearing East and West, $5\frac{1}{2}$ miles.

There are five tidal harbours in Mounts bay, viz., Mousehole, Newlyn, and Penzance harbours on the western shore of the bay; Mount St. Michael harbour on the northern side of the mount; and Port Leven on the eastern shore; but none of them should be run for with a ground swell on, or with gales blowing on the land. The principal anchorage in the bay is in Gwavas lake, off Newlyn harbour.

Both Mounts bay and Gwavas lake afford good anchorage, and are sheltered from all winds, excepting those between S.S.W. and S.E., which send in a heavy breaking sea, against which few vessels could ride with any prospect of success, were it not for the powerful undertow, the resistance of which, as in Torbay, increases with the strength and duration of the wind, thus enabling them to ride easy. In the winter season, however, the bay should not be resorted to, save as a preliminary step, when wishing to enter mount St. Michael or Penzance harbours.

On the eastern side of the bay are several spots of foul ground, but there are places where the bottom is good, and vessels may lie sheltered from easterly winds. Good anchorage will be found during strong easterly or south-easterly gales on the north-west side of Mullion island, in about

10 fathoms water ; great care, however, must be taken to guard against a sudden shift of wind to the westward.

There is also good anchorage in 7 fathoms, fine white sand, sheltered from easterly winds, about a mile to the S.S.W. of Loo pool ; also in 11 fathoms, hard sand, off Port Leven, with Helstone church, N.E. by E. $\frac{1}{4}$ E., and Cuddan point, N.W. $\frac{1}{2}$ N. Between port Leven and St. Michaels mount the coast is foul, with many outlying dangers, and vessels of large draught should not venture into a less depth than 14 fathoms.

MOUSEHOLE HARBOUR, formed by two piers, is $1\frac{1}{4}$ acres in extent, and sheltered from E.S.E. to S.E. by S. by St. Clements island. The southern pier extends 147 yards in a N.E. by E. $\frac{1}{2}$ E. direction, and is 47 feet wide ; the northern pier, only 18 feet wide, runs out curving to the southward to the distance of 76 yards, leaving an entrance between the pier heads of 49 feet. The harbour carries a depth of about 7 feet at high water springs, and 4 feet at neaps, over a bottom of gravel on rocky ground.

The southern passage to the harbour, between St. Clements island and the main, is about $1\frac{1}{2}$ cables wide ; the northern passage, also between that island and the main, is both foul and contracted, and only half a cable wide.

From Mousehole to Penlee point the shore is rugged, consisting of heavy masses of loose rocks ; and near the eastern side of the harbour's mouth are some detached rocks, extending nearly three-quarters of a cable from the land. The cliffs are only 20 feet high near Mousehole, but increase to 50 and 60 feet near Penlee point, the land rising abruptly to 224 feet, leaving only sufficient space for a roadway ; and thence they soon decrease to an average height of 35 feet, the land gradually sloping to them, and this feature continues to Newlyn point, which is about a mile to the northward.

A rocket apparatus is kept in Mousehole harbour.

Low Lee Rock, with only 4 feet water, lies a third of a mile eastward of Penlee point, with the extreme cliff at Penzer point in one with the northern hummock of St. Clement's island, S. W. $\frac{3}{4}$ W. ; and the tower of St. Pauls church in line with the southernmost new barn, W. by N. $\frac{1}{2}$ N. A red buoy is moored 30 yards eastward of the rock.

Carn Base Rock, also with only 4 feet, lies North nearly a third of a mile from Low Lee rock, and about the same distance from the shore. The marks for it are St. Paul's church tower in line with the southern side of the longest hedge, bearing W. $\frac{1}{2}$ S. ; and Trithal engine-house on with the eastern chimney of the coast-guard house, North.

Low Lee and Carn Base rocks are small in extent, and steep-to on all sides.

NEWLYN HARBOUR.—A curving pier, 69 yards long and 5 broad, runs about 27 yards in a northerly direction from the village of Newlyn. The harbour thus formed is about half an acre in extent, carries a depth of 6 feet at high water springs, and 3 feet at neaps, over gravel bottom, and is capable of containing from 30 to 40 boats averaging 15 tons burthen. The sand dries outside the pier to the distance of 104 feet at the lowest tides.

Between Newlyn and Gwavas Slips, which are 83 yards apart, is Gwavas cliff, about 40 feet high, in the direction of which is the clearest and safest place to beach a vessel; and thence to Tolcarn bridge, a flat, stony shore extends off a cable from high to low water mark. From Tolcarn bridge to the coast-guard house, the rocks, which cover at three-quarters flood, extend $1\frac{1}{2}$ cables off the shingle beach; and thence to the parade wall at Penzance, they run off the same distance from a sandy shore.

PENZANCE HARBOUR, in the extreme northern part of Mounts bay, is formed by two piers, and the tide rises in it 17 feet at high water springs, and 13 feet at neaps. The northern pier runs out 572 yards in a southerly direction from the inner wall; and on the extremity of the southern pier, which is irregular in shape, stands an iron lighthouse erected on its extremity. The entrance between the pier-heads is 110 yards wide. The harbour is 28 acres in area, and contains one building yard, and a dry dock on its western side, in which vessels of 800 tons burthen have been repaired.*

The dry dock is 128 feet in length, 35 in breadth, and has 12 feet over sill at high water springs and 8 feet at neaps; cranes are erected on the piers, capable of lifting from 5 to 10 tons. There are $25\frac{1}{2}$ feet at high water springs at the extreme of the eastern extension of the harbour, and $22\frac{1}{2}$ feet at neaps. Abreast the northern pier end there are 16 feet, and the depth decreases gradually to 14 feet at the head of the harbour. In 1868 the number of vessels belonging to the port was 101, representing 9,856 tons; and at the same time 708 coasting vessels entered inwards, and 267 outwards, whilst 59 entered from foreign. The population of the town, in 1861, was 9,414.

LIGHT.—The lighthouse on the end of the southern pier of Penzance harbour is 22 feet high, and coloured white. It exhibits at 33 feet above high water a *fixed* light, which shows *red* for 80° of the circle, or from about a cable's length south of the beacon on the Raymond rock, to about the same distance east of the beacon on the Gear rock, when there are 15 feet water at the pier head, which is quite 8 hours out of the 12; the

* See Admiralty Plan of Penzance Bay, No. 2,345; scale, $m=6$ inches.

remainder of the circle it shows white. When less than 15 feet, the light shows *green* instead of red. The light is of the fifth order, and visible in clear weather from a distance of 10 miles. A ball is hoisted on a pole at the end of the old pier by day, when there are 15 feet water at the pier-head.

Life Boat.—A life boat, and mortar apparatus are kept in readiness in the boat-house at the head of Penzance harbour.

PILOTS.—There are 16 Trinity pilots at Penzance. They have no vessel, but are supposed to be always on the look out for ships on the heights, or in their boats.

Gear Rock.—A rocky ledge known as the Battery rocks, extends a cable S.S.W. of the southern arm of the south pier of Penzance harbour and at the same distance without them and in the same direction are some detached rocks, which narrow the 4-fathom channel between them and the Gear rock to a cable in breadth. The Gear, on which is an iron beacon, lies upwards of 4 cables S. by W. $\frac{3}{4}$ W. from the lighthouse, and covers at a third flood. The marks for it are, the R. C. chapel in Penzance in line with the east end of St. Mary's church N. $\frac{1}{2}$ W.; and the middle of Trewarveneth clump of trees W. by S. $\frac{1}{4}$ S.

Cressar and Bloon Rocks.—The shore at the head of Mounts bay, from Penzance to the bridge at Marazion, is low and flat, and composed of sand and shingle, which runs off from high-water mark to the Long rock, a distance of nearly 2 cables. Nearly three-quarters of a mile eastward of Penzance harbour, and about a third of a mile from high-water mark, is the south extreme of the Cressar rocks, which cover at two-thirds flood; their western limit, only four cables eastward of the harbour, is marked by an iron beacon, painted red, surmounted by a ball.

The Bloon or Raymond rock lies S.E. by E. $\frac{3}{4}$ E. upwards of half a mile from the beacon on the Cressar, and nearly half a mile from the shore, its north extreme nearly touching Long rock; it is also marked by an iron beacon painted red, with a ball.

Hogus Rocks.—The beach eastward of the Long rock extends a cable from high water mark, and the shore to mount St. Michaels forms a bay, on the eastern side of which are the Penzeath and Hogus rocks. The Penzeath is a small patch lying half a mile eastward of the Long rock at $1\frac{1}{2}$ cables off shore, and covers at one hour's flood. The Great Hogus is a rocky cluster lying upwards of a third of a mile off shore between the mount and the Penzeath; and the Little Hogus, which covers at three-quarters flood, is about a quarter of a mile off shore between the Great Hogus and the Penzeath.

Venton chimney-shaft in line with the end of the western pier of mount St. Michaels harbour, bearing E. by S. $\frac{3}{4}$ S., leads south of the

Cressar and Bloon rocks and the shoals without them, in about 3 fathoms at low water.

MOUNT ST. MICHAELS HARBOUR, $2\frac{1}{2}$ acres in extent, is formed by two piers on the northern side of the mount, and carries a depth of 11 feet at high water springs, and $7\frac{1}{2}$ feet at neaps. The northern pier, 24 feet wide extends 152 yards in a north-east direction, when it abruptly turns S.E. $\frac{1}{2}$ E. for a distance of 22 yards. The southern pier runs N.N.E. for 77 yards, and then bends N.N.W. $\frac{3}{4}$ W., the whole length being 129 yards from its inner part. The entrance between the pier-heads is 124 feet wide, faces the north-east, and has 16 feet in it at high water springs and $12\frac{1}{2}$ feet at neaps.

Guthen and Maltman Rocks must be carefully avoided by vessels approaching mount St. Michaels harbour. The Guthen, with only 10 feet water, lies upwards of a cable off shore in a W.N.W. direction from the castle on the mount. The Maltman lies about a cable off shore, S.W. $\frac{1}{4}$ S. from the castle, and covers at first-quarter flood. On the eastern side of the mount, about 2 cables off shore, and E. by S. $\frac{1}{4}$ S. from the castle, are a small cluster of rocks awash at low water.

Acton castle in line with the hummock of Greeb rock, bearing S.E. $\frac{3}{4}$ E., leads south of the Maltman; and the Virgin Mine in line with the highest hummock of the Great Hogus, N.E. $\frac{3}{4}$ E., leads west of the Guthen.

Greeb Rock, 24 feet above high water, and lying between mount St. Michael and Cuddan point, is separated from the main by large masses of rock, which extend in a W. by S. direction from Maendu point; its outer extreme is nearly a quarter of a mile from the shore, and has a detached rock off it. Between Greeb rock and the mount the coast forms a small bay, with several shoal patches in it; off its low and rugged shores the low-water rocks extend three-quarters of a cable, and a third of a cable without them at the several points lie detached rocks.

Bears Rock.—From the Greeb, Cuddan point bears S.S.E. $\frac{1}{2}$ E. $1\frac{1}{4}$ miles, the coast between forming a bay, in the northern part of which is a cluster of rocks, called the Bears, which cover at two-thirds flood; the outer rock lies S.E. by E. $1\frac{3}{4}$ cables from the hummock of the Greeb.

From Maendu point, which is high and rocky, the cliffs descend abruptly to a low shore, to the southward of which are the Perran sands; and thence to within a sixth of a mile of Cuddan point the shore is flat and rocky. To the north-westward of Cuddan point is a rock standing well out of the water about 150 feet off shore; and a third of a cable to the southward of the extreme point is the Shag rock, which barely covers at high water.

Stones Shoal.—The cliffs around Cuddan point are high and precipitous, and to the southward of the point are several rocky shoals. The nearest is the Stones shoal, which dries at two different spots at low water springs. From the depth of 2 fathoms on its edges, it is about a sixth of a mile in length, north and south, and a cable in breadth. Its western edge bears S. by E. $\frac{1}{2}$ E., about half a mile from the Shag rock, and a dry spot on its northern part bears S.E. by S. a short half mile, where the tower of the castle on the mount is in line with the Shag, N.W. by N. To pass north of this shoal, shut the mount tower in with Cuddan point.

Mountamopus Shoal, lying about three-quarters of a mile to the southward of Cuddan point, is $1\frac{1}{2}$ cables long, and nearly a cable broad. From its shoalest part of 5 feet, Acton castle is in line with the hummock of Cuddan point N.E. $\frac{3}{4}$ N., and Pengersick castle is on with the extreme of Hoe point E. by N. A black buoy marks its southern edge.

Carn Mallows Shoal has several patches of 3 fathoms on it lying half a mile S.E. from the shoalest water on the Mountamopus. From this part Trebarvah farmhouse is in line with the extreme of Cuddan point, N. $\frac{3}{4}$ E. From the eastern part of the bank, which has 4 to 5 fathoms on it, Perranuthno church tower is on with the outer saddle of Cuddan point, N. $\frac{3}{4}$ W.

The sea breaks heavily on the Stones, the Mountamopus, and on the Carn Mallows shoals in bad weather, with the wind from S.S.E. to West.

Iron Gates, the outer shoal off Cuddan point, is a small rocky patch of 4 fathoms, lying S.W. $\frac{1}{2}$ S. 2 miles from the point, with Acton castle open eastward of the hummock of Cuddan point, N.E. $\frac{1}{2}$ N.; the hummock on the Old Lizard head touching Rill head, S.S.E. $\frac{1}{2}$ E.; and Mountamopus buoy N.E. Trithal engine-house in line with the R. C. chapel at Penzance, N. by W., leads a mile westward of this shoal. Between the Iron Gates and the Mountamopus there is a good channel three-quarters of a mile broad, carrying a depth of 6 to 10 fathoms. The mark to lead through is Rogers tower, or Castle an Dinas in one with the mount tower, bearing N. $\frac{1}{2}$ W. westerly.

Ludgvan church in line with the mount tower N. $\frac{1}{4}$ E., or Acton castle open westward of Cuddan point N.E., leads westward of all the shoals off Cuddan point; and Trigoning signal-hill open eastward of the town of Trewavas N.E. $\frac{1}{4}$ E., leads eastward.

Welloe Shoal lies two-thirds of a mile S.W. $\frac{3}{4}$ W. of Rinsey beacon, and upwards of half a mile from the cliff immediately below the beacon. From the part which dries 5 feet at low-water springs, Bessys house (in the first bight westward of Prussia cove) is in one with the Ynys rock, N.N.W. $\frac{3}{4}$ W.; and Trewavas farmhouse is in line with Rinsey mine

counting-house N.E. by E. $\frac{1}{4}$ E. The hummock of Cuddan point on with the mount tower, N.W. by N., leads south of this shoal.

Great Row Shoal, lying upwards of a mile S.W. by W. of the Welloe, has only 3 fathoms on it, and foul and uneven ground on all sides. The marks for it are, Trewavas farmhouse on with the south gable of Rinsey mine counting-house, N.E. by E.; and Perranuthno church tower in line with the inner saddle of the Cuddan N. by W. Madron union on with the R. C. chapel at Penzance, N.N.W. $\frac{3}{4}$ W., leads south-west of this shoal; and Trigoning hill open eastward of Trewavas farmhouse, N.E. $\frac{1}{4}$ E., leads south-east.

PRUSSIA COVE.—From Cuddan point the cliffs do not vary until near the Ynys rock, three-quarters of a mile to the eastward, when they turn inwards to the bight, and gradually decrease in height to the low point near the coast-guard station in Prussia cove, which is between the Ynys and Hoe point; the shore of this cove is composed of sand and scare,* and extends off nearly a cable's length from the bight. The cliffs from the coast-guard to Hoe point are 65 to 50 feet high, and again terminate in the bight which forms the north-west part of the Pra sands. From the eastern limit of Prussia cove to the end of the cliffs at the north-west part of these sands, are a series of high detached rocks extending some distance off shore; those off Hoe point lie nearly a cable from the cliff.

A rocket apparatus is kept in Prussia cove.

PRA SANDS.—From Hoe point the land to the eastward continues low for two-thirds of a mile, forming between that point and Rinsey head a small bay bordered by the Pra sands, which extend off $1\frac{1}{2}$ cables to low-water mark. From the eastern termination of these sands the cliffs increase in height, Rinsey head being 80 feet above high water, and continue with little variation until they reach Trewavas head, which slopes to seaward to a cliff 35 feet high.

A short distance south-eastward of the Pra sands the shore is composed of heavy masses of loose rocks, which extend off nearly two-thirds of a cable; and thence to Trewavas head the low-water rocks are shelving and diverge from the cliffs, except in the two bights to the south-eastward of Rinsey head; the one close to the head having scare running off a third of a cable from the shore, and the other having flat rocks within, and sand without, extending off half a cable to low-water mark.

At $1\frac{1}{2}$ cables from Trewavas head and a third of a cable off shore is a sunken rock; and thence to port Leven, which is nearly $1\frac{3}{4}$ miles S.E. of the head, the cliffs rise to about 150 feet.

* Scare, scar, skain or sgein, on the English, Irish, or Scottish coasts mean rough rocky ground.

PORT LEVEN.—The entrance to this tidal harbour is 240 feet wide, and is formed between the end of the pier, which extends off 137 yards in a westerly direction, and the Deazle rocks, which cover when the tide has risen $2\frac{1}{2}$ feet at springs. At $1\frac{1}{4}$ cables within the entrance, the harbour curves to the northward, and the distance between the outer pier-heads is 134 feet. At 73 yards farther in are the inner pier-heads, with gates 32 feet wide. The entrance is directly open to the westward, and balks of timber are lowered to protect the gates, if required. There are 6 feet at low-water springs between the end of the pier and the Deazle rocks; and thence the bottom rises, and on the gate sill there are $13\frac{1}{2}$ feet at high-water springs, and 10 feet at neaps. From 80 to 90 fishing boats and 10 vessels belonged to Port Leven in 1860. The exports are, china, clay, copper, tin, and fish; the imports, coal, and timber.

LOO POOL, about a mile south of Port Leven, is sometimes mistaken for the latter. It forms a deep inlet of retained water, the entrance being blocked up by a bar of shingle 34 feet above low water springs.

From port Leven the coast is low to Loo pool, after which the cliffs vary from 50 to 200 feet in height, the shore between continuing sandy to within two-thirds of a mile of Pedngwinion head; and thence to Pradanack point the cliffs are 100 to 200 feet high, and the low-water rocks extend about half a cable off shore. A rocky patch, awash at low-water springs, called the Viziers lies N.W. b. N. nearly 2 cables from Pedngwinion head, and about a cable from the shore. The Vradden rock lies awash at low water in a W.N.W. direction about 2 cables from Pradanack point.

MULLION ISLAND, a quarter of a mile north-east of Pedncrifton point, rises 118 feet above high water, and is precipitous on its W.N.W. side. There is good anchorage on its north-west side in strong easterly or south-easterly gales, in about 10 fathoms water, with the island bearing S. $\frac{1}{2}$ E., and Mullion church E. $\frac{3}{4}$ S.; but every preparation should be made to weigh if the wind shifts to the westward.

Life Boats.—A life boat is stationed at Port Leven, and there is also one at Mullion.

RILL HEAD.—From Pradanack point to the Lizard the cliffs are 250 to 200 feet in height, and between them is Rill head, off which at a cable's length are two detached rocks, bearing W.N.W. and S.W. by S. from the head. About half a mile south-eastward of the head and close in shore is Kynance island, within which to the eastward is Kynance sandy cove.

The Sea is a rocky shoal of 6 fathoms water, which breaks heavily in S.W. gales. From it Rill head bears E. $\frac{3}{4}$ S., distant $1\frac{1}{2}$ miles; the Lizard S.E. by E. 3 miles; the eastern Lizard lighthouse is in one

with Old Lizard head, S.E. by E.; and the eastern extreme of Mullion island is in line with Pedncrifton point, N.E. $\frac{1}{2}$ N.

DIRECTIONS.—Approaching the coast between the Lands End and the Lizard from the offing, the soundings will decrease in tolerable regularity over a bottom of coarse sand, interspersed with whole and broken shells.

If bound into Mounts bay from the westward, to avoid the Runnel-stone, keep Godolphin hill—which rises to the height of 532 feet about 4 miles westward of Helstone—open of Carndu point, bearing about E. $\frac{3}{4}$ N.; and as that point is approached, mount St. Michael must be opened south of it to clear the Buck rocks. When abreast Carndu point, keep Tetterdu point well open south of the Carn Barges to avoid the Lelland, after which the shore may be approached to a quarter of a mile. After passing St. Clements island, bring Trithal engine house in one with York house, N. $\frac{1}{4}$ W., and it will lead eastward of the Low Lee and Carn Base Rocks, and direct to the anchorage in about 9 fathoms, with the tower on mount St. Michael in line with St. Hilary church spire bearing East; and the beacon on the Gear rock N. by E. $\frac{3}{4}$ E. The best anchorage for coasters is farther to the westward in Gwavas Lake in about $4\frac{1}{2}$ fathoms, with St. Clements island shut in with Penlee point.

In approaching the bay from the southward, when between Carndu and Cuddan points, and proceeding in the line towards Gulval at the head of the bay, the soundings will gradually decrease from 20 to $9\frac{1}{2}$ fathoms at low water. In the latter depth, which is nearly $1\frac{1}{4}$ miles from the shore, haul to the westward for the anchorage.

At Night, the white light on Penzance pier will open of the western coast of Mounts bay when entering from the westward. Run to the eastward till the red or green light—red or green according to the depth of water at the pier-head, (see pages 40–41)—comes in sight. The western limit of the red or green light is an excellent mark to vessels bound into the bay from the westward, as it leads eastward of the Low Lee and Carn Base rocks, which have only 4 feet water on them. It is also serviceable as a mark when beating up for Penzance, for by tacking on its western limit a vessel will avoid all danger on the western side of the bay, and by tacking on its northern limit she will avoid the foul ground off the Bloon or Raymond, and Cressar rocks in the northern part of the bay.

Entering from the eastward, after rounding the Lizard and the Boa shoal, if there is much ground swell on, bring the red (or green) light on a N. by W. $\frac{1}{4}$ W. bearing before standing for it, by which

means the Iron Gates shoal will be avoided, for during that time the sea breaks heavily both upon it and the Boa shoal. In fine weather the seaman must use his own discretion when hauling to the northward, and it will only be necessary to remark that the westernmost of the Lizard lights kept in sight bearing S.E. by S. will lead south of the Iron Gates and up to St. Clements island.

CHAPTER III.

LIZARD HEAD TO START POINT.

 VARIATION IN 1869.

Falmouth	-	-	-	22° 15' W.
Fowey Harbour	-	-	22° 15' W.	Plymouth Sound - - 22° 5' W.
Looe Harbour	-	-	22° 15' W.	Salcombe River - - 22° 0' W.

LIZARD HEAD is a bold and precipitous promontory, whence vessels generally take their departure on leaving the Channel, and use as a landfall when homeward bound. In clear weather it will be seen about 24 miles off, and be readily known by its two white lighthouses. A vessel may approach it with confidence by night as well as by day, if the weather be at all clear, remembering, however, that the dangers in its vicinity extend off nearly half a mile.*

The land between the Lizard and Start point is, generally speaking, moderately high, and being for the most part double, exhibits a great variety of elevation to a vessel in the offing as she varies her position. It also contains many deep openings between Helford and Looe, which at a distance seem to destroy the connexion. At $9\frac{1}{2}$ miles north-east of the entrance of Falmouth, and nearly midway between the Lizard and Rame head, the Dodman stands out boldly to seaward; it is a precipitous bluff 300 feet above the sea, its steep face being towards the east, and declining gradually to the westward. Gribbin head to the westward of Fowey, and immediately succeeding the deep bight of Polkerris, is distinguished by a beacon tower 84 feet high, standing on an elevation 250 feet above high water; and thence to Looe the land continues high and irregular; rather declining towards Whitesand bay, but rising again in the vicinity of Plymouth.

LIGHTS.—The lighthouses on the Lizard are 61 feet high, and 74 yards apart on a W. by N. and E. by S. bearing. They each exhibit a *fixed* white light, visible in clear weather from a distance of 21 miles.

* See Admiralty Charts; England, South Coast, Sheet 1, No. 2,565, scale, $m = 0.5$ inch; Plymouth to the Lizard, No. 29, scale, $m = 0.8$ inch; and Lizard and adjacent rocks, No. 2,447, scale, $m = 6$ inches.

The eastern light is 229 feet, and the western light 232 feet above the level of high water, and when in one they lead $3\frac{3}{4}$ miles south of the Manacle rocks, and the same distance south of the Wolf rock.

A Life Boat is placed at Polpear point, about a cable's length westward of the Lizard lighthouses.

The Stags.—The rocks, commonly called the Stags, lying off the Lizard, are the Mulvin, the Man-of-War, the Carligga, and the Maenheere, to the south-westward and southward; and within the latter to the northward lie the Crenval and Ennach. They extend off nearly half a mile from the coast, and have from 5 to 9 fathoms water close to and among them; and within them are masses of detached rocks nearly joining the shore.

The Mulvin covers at high-water springs, and bears W. by N. northerly, distant two-thirds of a mile from the lighthouses. The Man-of-War rocks bear W. $\frac{1}{2}$ N. nearly the same distances from the lighthouses, and S.E. $1\frac{1}{2}$ cables from the Mulvin. The Carligga bears S.W. by W. $\frac{1}{2}$ W., and the Maenheere S.W. $\frac{1}{4}$ S., nearly half a mile respectively from the lighthouses, and N.E. and S.W., distant $1\frac{1}{2}$ cables from each other; they cover at three-quarters flood, and within them are patches of detached rocks nearly joining the shore. The Ennach lies nearly $1\frac{1}{2}$ cables north-eastward of the Maenheere, and covers at half-flood.

The Vrogue is a dangerous rock with only 6 feet water, lying S.E. distant 4 cables from Beast point. Three beacons, painted red, have been erected on the land to mark its position; one beacon is on the Balk, and the two others, 8 feet high and 96 yards apart, are on Beast point. From the rock, Ruan Minor church tower is in line with the western ridge at the entrance to Cadgwith, N. by E. $\frac{1}{2}$ E.; the beacon on the Balk bears N. by W. westerly, distant $8\frac{1}{2}$ cables, and is in line with the middle hummock (whitewashed) on Hot point; and the two beacons on Beast point are in one bearing N.W.

The Balk beacon in line with the extreme of Hot point N. by W. $\frac{1}{2}$ W. leads a cable's length north-east of the Vrogue; and Polpear point open of the Bumble, W.N.W., leads the same distance to the southward.

Spernan Shoals are rocky patches of 5 fathoms lying eastward of the Vrogue. From the eastern or outer patch, the lighthouses on the Lizard bear W. by N. $\frac{1}{4}$ N. distant nearly $1\frac{1}{2}$ miles (the top of the western lighthouse is just showing south of the eastern one); Hot point N.W. $\frac{1}{4}$ W. three-quarters of a mile; and Treleague house is in line with the western face of Cadgwith cliff, N. $\frac{1}{4}$ E.*

Craggan Rock with only 5 feet water, lies S. $\frac{1}{2}$ W. nearly two-thirds of a mile from Cadgwith cove, with Beast point bearing S.W. by W. nearly a

* See Views A and B on Plan of the Lizard.

mile ; Landewednack church, West a little southerly ; and Treleague house in line with the western face of the entrance to Cadgwith. A small rock, named the Va, lies off Perran Vose cove ; it is distant nearly 2 cables S.E. $\frac{3}{4}$ E. from the extreme of the Balk, and covers at 3 feet flood.

TIDAL STREAMS.—At the Lizard it is high water, full and change, at 5h. 0m. ; springs rise $14\frac{1}{4}$ feet, neaps $10\frac{1}{2}$ feet. At the Eddystone at 5h. 15m. ; the rise 16 feet and 12 feet. At the start at 5h. 41m. ; the rise 15 feet and $11\frac{1}{2}$ feet.

Abreast of Plymouth Sound, about 6 miles from the land, the streams are very irregular. About $1\frac{3}{4}$ hours before high water at Devonport the stream makes to the eastward, and runs for an hour about E. by S. ; during the next hour it is scarcely sensible, after which it turns to the southward, gradually changing to W.S.W. till the last quarter ebb on the shore, when it veers from W.S.W. to W.N.W. During the first 3 hours flood on the shore, its direction changes from W.N.W. to N.W., when it begins to slacken, and set about North, till at the last $4\frac{1}{2}$ hours flood it runs E. by S. as at first. The maximum velocity of either stream does not exceed $1\frac{1}{2}$ knots.

Four miles south-west of the Eddystone the stream begins to run E. by S. when it is high water at Devonport, and continues about $2\frac{3}{4}$ hours, when it slacks and shifts to the southward. At $3\frac{1}{4}$ hours ebb on the shore it sets W.S.W. ; at 4 hours W. by N. ; and then W.N.W. until low water. During the first 2 hours flood on the shore the stream sets N.W. by W. ; and loses its strength during the third hour, running N.W. and North. During the fourth hour, what little stream there is sets N.N.E. and N.E. ; and then E.N.E. and E. by N. till about high water, when its direction is E. by S.

From Bolt tail to Start point, at 4 miles off shore, the eastern stream makes 3 hours after ~~high~~^{low} water, and the western stream 3 hours after ~~low~~^{high} water on the shore ; the stream sets along the land, and its greatest velocity is $2\frac{3}{4}$ knots. At neaps the turn of the stream is irregular, varying from 4 to 7 hours after high and low water on the shore ; the average being 5 hours. Its rate at neaps is $1\frac{1}{2}$ knots ; but off the Start $2\frac{1}{2}$ knots.

RIPPLINGS.—South of the Stags there is always an extensive rippling on both streams of tide, stretching as far seaward from the rocks as 2 or 3 miles ; this is chiefly occasioned by the unevenness of the ground, and when it blows strong from seaward during spring tides, the sea is short and violent.

There is another extensive race or rippling to the south-east of the Lizard, but it is occasioned by the confluence of the tides. At 2 hours ebb the stream at the Manacles begins to run to the S.W., where meeting with

the stream out of the bight between Cadgwith and Black head, which sets to the eastward from half-ebb till 5 hours flood, they unite and both set to the south-east; but at 2 hours flood the stream at the Manacles again begins to turn, and this S.E. line of direction is warped more easterly, till at high water it ceases altogether.

DIRECTIONS.—Godolphin hill, in line with Pradanack point, or Pradanack point open westward of Rill head, N. $\frac{1}{4}$ W., leads a third of a mile westward of the Stags; and Ynys head, or the beach at Kennack cove, kept in sight eastward of Beast point, about N.E., leads nearly half a mile eastward. But to avoid all the shoal water off the Lizard, keep Godolphin hill open of Rill head, N. $\frac{1}{4}$ W., until Lowland barn opens of Black head, N.E. by E.

The course from the Lizard to the Start is about E. $\frac{3}{4}$ S., and the distance 63 miles. When navigating this portion of the Channel, by not standing into less water than 42 fathoms, a vessel will pass at least 5 miles south of the Eddystone, the parallel of which will not be approached eastward or westward of that rock so long as that depth is preserved. In the stream of the Eddystone there are from 34 to 37 fathoms; the ground in the former depth consists of coarse and fine sand, but in the latter a sort of dark greenish muddy sand, and extends nearly 10 miles in a westerly, and 4 miles in a southerly direction, from the Eddystone. From the western extremity of this muddy sand the steeple of Rame church appears open westward of the summit of Rame head, and Loo island bears N.N.E. $\frac{3}{4}$ E.

Proceeding eastward from the Lizard during the night, the lights kept just in sight south of Beast point,* about E. $\frac{1}{4}$ S., will lead $1\frac{1}{4}$ miles southward of Black head, and direct to the Eddystone. In thick weather come no nearer the Lizard than the depth of 47 fathoms, which water will be found only 6 or 7 miles distant from it.

The COAST from the Lizard trends E. by N. $\frac{1}{4}$ N. 5 miles to Black head, and then N.E. $\frac{3}{4}$ E. $3\frac{1}{2}$ miles to Manacle point. Between the Lizard and Kennack cove the cliffs, from 160 to 200 feet in height, terminate in a low sandy bight; they then rise abruptly to 200 feet, and so continue to Black head, which is 218 feet above high water. Between the Lizard and Black head are several coves, called Housel, Perran Vose, Cadgwith, and Beagle, which are occasionally frequented by coasters in strong northerly winds.

Between Cadgwith and Kennack coves the shore must not be approached

* This promontory forms the eastern part of the land at the Lizard, and being considerably higher than the Lizard lighthouses, excludes the view of the lights from vessels if they approach nearer to Black head than the distance of $1\frac{1}{4}$ miles.

within the distance of 2 cables, as it is bordered with outlying rocks which cover from a quarter to three-quarters flood. A small rock, named the Bo, lies in the entrance to Cadgwith, and covers at a quarter flood. A mass of rocks, named the Caerverrack, extends $1\frac{1}{4}$ cables in a southerly direction from the Kennack sands, and their outer part covers at half flood. At about half a mile distant from the Karak-clews rock, on a line between it and the Caerverrack, and nearly a sixth of a mile off shore, is the Jay rock, which covers at two-thirds flood. From the Karak-clews to Black head, the chief outlying rocks extend in a southerly direction two-thirds of a cable from Pedn Boar point, and cover at a quarter flood.

A group of high rocks, part of which never cover, extend from the shore about a cable's length South from Black head, and at their outward extreme is a small detached rock which covers at a quarter flood. Between Black head and Chynhals point, the low water rocks project off shore upwards of a cable, and also in a southerly direction to a sixth of a mile from that point; to the eastward of the point, and about a cable from the shore, lie the Guthens rocks, which cover at high water. From Black head to Chynhals point, which projects to the eastward, and is elevated 92 feet above high water, the cliffs are about 200 feet high; but thence to Lowland point they are only 10 to 20 feet high, with a ridge of land rising abruptly to 300 feet at the back.

About half-way between the pier at Coverack cove and Lowland point, are a patch of rocks called the Pen-y-maen which extend upwards of a cable in a southerly direction from the shore, and cover only at the highest tides; rocks continue to range from one to $1\frac{1}{2}$ cables off shore, until abreast of the Great Wrea, and without these are three outlying rocks called the Dava, the Hoar, and the Little Wrea.*

The Dava covers at half-flood, and from it the Carndu Manacle is in one with the Little Wrea, bearing E. by N. $\frac{1}{2}$ N. The Hoar bears N.E. by E. $\frac{1}{2}$ E. $1\frac{1}{2}$ cables from the Dava, and also covers at half-flood. The Little Wrea covers at high water, and lies E. by S. $\frac{1}{2}$ S. 2 cables from Lowland point; and at a third of a cable from it, in the same direction, is a sunken rock with only 10 feet water. The Great Wrea is a detached rock, which covers at high water, lying South nearly a cable from Lowland point; it has several small rocks at a third of a cable south-west of it.

From the Little Wrea, the Foam rock with 4 feet water (discovered in 1868), lies E. $\frac{1}{2}$ N. 2 cables; and the Meanland rock N.E. by N. nearly a third of a mile, and covers at a third flood; at a third of a cable westward of it are three small rocks which cover at a quarter flood.

* See Plan of the Manacle rocks, on Admiralty Plan of Longships, No. 2,473; scale, $m = 6$ inches.

Black head open of Lowland point, S.W. by W. $\frac{1}{2}$ W., leads south of the Meanland; and in one with Lowland barn leads north.

The cliffs from Lowland point to Manacle point are 20 to 50 feet high, and the shore is composed of large boulders to the north side of the bight, but thence it is studded with high detached rocks. From the latter point to Polkerris point the cliffs are about 60 feet high. Off Manacle point lie the Carclase rocks, the highest of which is about 22 feet above high water; their outward extreme is upwards of a cable's length from the shore, and at about the same distance S. by W. $\frac{1}{4}$ W. of the high Carclase is a rock which covers at a third flood. The Verwin are two detached rocks, the highest of which covers only with extreme high-water springs, and bears N.N.E. $\frac{1}{4}$ E. a cable from the Carclase; their northern side is nearly connected with a rocky ledge. Off the higher Verwin are three rocks covering at a quarter flood, the centre rock bearing W.S.W. distant half a cable's length.

COVERACK COVE, between Chynhals and Lowland points, affords shelter for coasters with the wind from S.W., round by the west, to N.E. The best anchorage is in about 4 fathoms, with the end of the pier bearing W. by S. $\frac{1}{2}$ S. distant a quarter of a mile. The pier runs out in a north-west direction from the shore, and affords shelter to the pilchard seine boats; it should not, however, be run for with gales blowing on the land or with a ground swell on. There are 12 feet within the pier at high water springs, and 8 feet at neaps.

TIDES.—In Coverack cove it is high water, full and change, at 4h. 35m.; springs rise $14\frac{1}{2}$ feet, neaps $11\frac{1}{4}$ feet.

PORTHOUSTOE COVE is a small bight close to the northward of Manacle point, and open to the eastward; on its northern side of entrance is a ledge of rocks extending three-quarters of a cable off shore. In a S. $\frac{3}{4}$ E. and S.S.E. $\frac{1}{2}$ E. direction from Pennera head, the next point to the northward, are two detached low-water rocks lying upwards of a cable off shore; and in a S.E. by E. direction, 2 cables off shore, is a small shoal with $2\frac{1}{2}$ fathoms on it.

MANACLES ROCKS consist of a dangerous group connected by ledges, about 3 miles E.N.E. from Black head, and S.E. $\frac{1}{2}$ S. upwards of three-quarters of a mile from Manacle point. They all cover at high water springs except the south-westernmost rock, named Carndu, which is 5 feet above that level; from it Maentenoweth rock, the northernmost of the group which covers at a third flood, bears N. by E. $\frac{1}{4}$ E. two-thirds of a mile. The outer or eastern rocks, named the Penwin and Vase bear from each other N.N.E. and S.S.W. and are distant half a cable apart, with 6 fathoms water between them.

The Penwin or outer rock is awash at low water, and from it Carndu rock bears W. by S. about half a mile; the Little Wrea is seen between the Carndu and Inner Maen Vose, W. by S. $\frac{1}{4}$ S.; and Mawnan church is in line with the high-water mark on Nare point, N. $\frac{3}{4}$ E. The marks for the Vase, which has 4 feet water, are the extreme of Black head in line with Inner Maen Vose rock, W. by S. $\frac{1}{2}$ S.; and St. Keverne church spire in line with Wingoes rock, N.W. by W. $\frac{1}{2}$ W.

Bell Buoy.—A black bell buoy, with staff and ball and the word *Manacles* on its head, is moored in 20 fathoms water, about half a cable south-eastward of the Penwin, with Mawnan church tower touching the first rise of Nare point, N. $\frac{3}{4}$ W.; the lighthouse on St. Anthony point, N.E. by N.; Black head W.S.W.; and St. Keverne church spire N.W. by W. $\frac{1}{4}$ W.

DIRECTIONS.—Coverack coast-guard watch-house open south of the Wrea rocks, W. $\frac{3}{4}$ S., leads half a cable south of the Manacles; but in proceeding towards these dangers from the Lizard, keep Beast point open of Black head W. by S., until the square tower of Mawnan church, which stands on a hill on the north side of the entrance to Helford river, appears well open north-eastward of the lowest extreme of land at Nare point, N. $\frac{3}{4}$ W. westerly. A vessel will be northward of all the rocks when the houses on the southern side of Porthoustoe cove come open, W. by N. $\frac{3}{4}$ N. At night keep the Lizard lights in sight to the southward of Beast point, W. $\frac{3}{4}$ N., until the fixed light on St. Anthony point bears N.N.E.

There is a passage inside the Manacles between the Maentenoweth and the outermost low-water rock of the Verwin, which bear E. by S. and W. by N. from each other, and are little more than a cable apart; but coasters in taking it from the south-westward must keep close to the south-eastern extreme of the Carclase, and after passing them bring the Little Wrea in one with their outer extreme bearing S.W. $\frac{1}{4}$ S., which will lead in the fairway between the Maentenoweth and the low-water rocks to the south-east of the Verwin.

Approaching this passage from the north-eastward, bring Little Wrea rock in one with south-east extreme of Carclase rocks S.W. $\frac{1}{4}$ S., and on nearing the latter steer to pass about a quarter of a cable's length from their eastern side.

PORTHALLA BIGHT.—From Polkerris point to Nare point the land slopes abruptly to the cliffs, and between is Porthalla bight, which is exposed to the eastward. The low water rocks extend upwards of a cable off the head of this bight; and thence to Nare head—which is a quarter of a mile southward of Nare point—the shore is bordered by masses of detached rocks.

To clear the south-eastern side of the low-water rocks extending E. $\frac{1}{2}$ S. a cable's length from Nare point, keep St. Keverne church well open of Nare head, S.W. $\frac{1}{4}$ S.; and to clear their northern side keep the houses in Flushing—which is on the southern shore of Gillans creek—open of Erra point, W. by S.

HELFORD RIVER.—At $1\frac{1}{2}$ miles N. by E. $\frac{1}{2}$ E. from Narn point is Rosemullion head, and between is the entrance to Helford river. The river trends in a W.N.W. direction from the entrance, and branches into picturesque creeks which penetrate the country in various directions.

DIRECTIONS.—Vessels wishing to enter this river may obtain the assistance of Falmouth pilots, who are always cruising in and about this locality. In entering be careful to avoid the Gedges rocks, which lie a quarter of a mile from the northern shore of the entrance, and cover at a third flood. Bosahan point kept open of Mawnan Chair point, W. by N. $\frac{1}{4}$ N., leads south of them; the tower of the Meteorological Observatory at Falmouth open of Pennance cliff, N.N.E. $\frac{3}{4}$ E., leads eastward; and a vessel will be westward of them when the Carndu or highest Manacle rock, is in line with the high-water mark on Nare point, S. $\frac{1}{4}$ W.

After passing the Gedges give the shore on either side of the river a berth of a good half cable until abreast of Dourgan, when the white house of Calamansack kept just touching the northern point of Porth Navas, N.W. by W. $\frac{1}{2}$ W., will lead up to the anchorage in 4 fathoms, mud bottom; the Old Ferry house bearing N. $\frac{3}{4}$ E.

GILLANS CREEK, close to the southward of the entrance to Helford, is only $1\frac{1}{2}$ cables wide, and nearly in mid-channel is a rock, which dries a foot at low water springs. The thatched house on the southern shore near Flushing, open, bearing W. $\frac{1}{4}$ S., leads close to the northward of the rock; and the same house shut in leads to the southward. Within Erra point there are only 2 feet at low water springs.

SWAN-POOL.—From Rosemullion head to Pennance point the cliffs are 20 to 50 feet high, and half way between the points is a sandy cove called Maen Porth. From Pennance point to Pendennis point the coast is irregular, the cliffs continue about the same height, and the low water rocks, which are shelving, extend nearly a cable off shore. Within the light to the northward of Pennance point is a deep inlet with a space of retained water named Swan-pool.

FALMOUTH HARBOUR affords capacious and secure anchorage, and is chiefly used as a port of call, as well as for shelter. Its entrance may be easily recognized by St. Anthony point to the eastward marked by a lighthouse, and by Pendennis castle on the western side, which stands on an elevation 233 feet above high water. The entrance is a mile wide, but

is divided into two channels, by Black rock, which lies E. by S. one-third of a mile from Pendennis point.*

The eastern channel between Black rock and the lighthouse is the best, as it is the wider of the two and carries the deepest water; with the wind at East a vessel can sail in free on the starboard tack, and at W.N.W. on the port tack. The western channel is only $2\frac{1}{4}$ cables wide, but as the least depth in it is 20 feet at low-water springs, it can be navigated by vessels of large draught at half tide; with the wind at N.W. by W. a vessel will sail in free on the port tack, and although the high land of Pendennis may cause it to baffle, yet there will be no danger when she has shot within the Black rock.

The harbour extends to the northward about 4 miles from the entrance, as far as Pill creek, and its shores are indented by several inlets quite landlocked. About $4\frac{1}{2}$ miles above Pill creek is the town and port of Truro, whose population in 1861 amounted to 11,337; at the quay spring tides rise $9\frac{1}{2}$ feet, and neaps 7 feet.

The trade at Falmouth is in corn, flour, potatoes, cattle, &c. In the year ending March 31, 1868, there were 137 vessels, and 206 boats registered as belonging to the port; whilst 2,543 vessels called for orders. There were 164 vessels from foreign, and 667 coasters entered inwards, and 27 vessels for foreign, and 165 coasters entered outwards. In 1861 the population amounted to 5,709.

Docks.—An outer or tidal harbour is partly formed, and two graving docks and a gridiron are constructed on the southern shore of Falmouth harbour, about half a mile from the town. One of these docks is 350 feet long, 50 feet wide at entrance, 14 feet water over sill at springs, and 11 feet at neaps; the other, 400 feet long, 65 feet wide at entrance, and 16 feet over sill. The gridiron is 170 in length, with 13 feet on it at high water springs. Spacious quays are built and the railway is brought down to the docks.

The tidal harbour, 42 acres in area, will be formed between two piers or breakwaters, and the entrance, 500 feet wide between the pier-heads, will face the north-east. A portion of the harbour and also the channel leading to it from the main harbour will be dredged to 18 feet at low water, or 34 feet at high water springs. The eastern breakwater, 1,400 feet long, is completed, and a depth of 22 feet has been made by dredging along its wharves at low water springs.

The floating dock, not yet commenced, is to be 14 acres in area, with an entrance leading from the tidal harbour 80 feet wide; is to have 29 feet over sill at high water springs, and 25 feet at neaps.

* See Admiralty Plan of Falmouth Harbour, No. 32; scale, $m = 3\cdot8$ inches.

Pilots.—In the Falmouth district, whose limits are Dodman point to the eastward, and the Lizard to the westward, there are 13 pilot cutters, varying from 30 to 40 tons, and 40 Trinity pilots, 20 of whom are entitled to take charge of vessels drawing 17 feet water and upwards; the remainder are for vessels of less draught.

A Life Boat is stationed at Falmouth.

LIGHTS.—The white, stone lighthouse on St. Anthony point, 62 feet high, exhibits from an elevation of 72 feet above high water a *revolving* white light, which shows a bright face every *twenty seconds*, and should be visible in clear weather from a distance of 13 miles. Coming from the eastward the light will first open out on a N.W. $\frac{1}{2}$ N. bearing; and thence it will be seen round seaward and up the harbour.

Also from the same lighthouse, a *fixed* white light is shown 37 feet below the *revolving* light; it is seen from seaward only between the bearings of N. by E. $\frac{1}{4}$ E. and N.N.E. $\frac{1}{2}$ E., and the western line of its visibility leads 2 cables to the eastward of Manacle rocks, to avoid which dangers the light was established. During foggy weather a bell is sounded.

A *fixed* green light is shown from the end of the eastern breakwater of the tidal harbour. It is elevated 27 feet above high water, and is visible from a distance of 3 miles.

The Old Wall with 27 feet water, and steep-to, is a pinnacle rock, from which the lighthouse on St. Anthony point bears North $1\frac{1}{4}$ miles; Restronguet smelting-house chimney, in line with the eastern extreme of the broken rocks off St. Anthony point, N. $\frac{1}{4}$ W.; and Greeb point, just showing east of Killygerran head, N.E. $\frac{1}{2}$ E. The pinnacle is so small that the lead falls off it into 5 and $5\frac{1}{2}$ fathoms; within it are a number of rocky 4-fathom patches of broken, uneven ground, extending nearly to the shore, and causing considerable overfall, especially with S.E. winds and a flood tide.

Black Rock dividing the entrance to Falmouth harbour into two channels, lies N.W. $\frac{1}{4}$ W. nearly three-quarters of a mile from St Anthony point, and covers about half flood, or when the tide has risen 8 feet at springs; but its position is indicated by a conical stone beacon surmounted with mast and ball.

The 3-fathom line extends $1\frac{1}{2}$ cables E. by S. $\frac{1}{2}$ S. from Black rock, and two patches of 17 feet water, lie respectively S.S.E. one cable, and S.W. $\frac{1}{2}$ S. $1\frac{1}{2}$ cables from it; whilst within the rock towards the spit of Falmouth bank there are some patches of 20 feet.

Lugo Rock lies three-quarters of a mile northward of St. Anthony point, and $1\frac{1}{2}$ miles S.S.W. from St. Mawes castle. It uncovers 2 feet at the lowest tides, and from it Mawnan church just shows north of the beacon on the Black rock, bearing W.S.W. A black buoy is moored 50 yards South from the rock.

St. Mawes and Falmouth Banks.—St. Mawes bank or flat borders the eastern side of Falmouth harbour, and nearly a mile northward of St. Mawes castle it stretches half channel over. This elbow or northern extreme, named the Vilt, is steep-to, and is marked by a black buoy. A black buoy is also moored on the 5-fathom edge of this bank on the eastern side of the Narrows, a third of a mile N.W. $\frac{1}{2}$ N. from the castle.

Falmouth bank or flat extends from Pendennis point to Mylor point, and fills up the whole of the western portion of Falmouth harbour. Its outer or eastern edge forms the western side of the Narrows, and is marked by a white buoy, on its 5-fathom line, distant from the East buoy of the Narrows $1\frac{1}{2}$ cables.

Governor Rock is a detached 2-fathom patch, about a cable within the edge of the Falmouth bank, and is marked by a buoy chequered black and white, which lies 60 yards E. by S. from the rock, with the east end of Falmouth dock breakwater, touching the pier at Flushing N.W. $\frac{1}{4}$ N.; and black rock beacon S. $\frac{1}{4}$ E., half a mile.

ANCHORAGE.—There is good anchorage in 10 to 12 fathoms water, outside the entrance to Falmouth, about a mile S.W. by W. $\frac{1}{2}$ W. from St. Anthony point; but no sailing vessel should anchor farther eastward than to bring St. Mawes pier in line with Carricknath point; nor farther westward than Mesack point in one with Black rock beacon; nor farther off than to have Penare head just open of Killygerran head bearing E.N.E.; or Budoc church in line with the middle of Swan-pool sandy bay, N.N.W. $\frac{3}{4}$ W. In any position within the space thus marked out, she may, on the wind veering to the eastward, and rendering it an unsafe anchorage, either proceed to sea with ease, or run into the harbour, the entrance to which is by these means kept open.

Small vessels cross over Falmouth bank and anchor between the town and Trefusis point in about 2 to $2\frac{1}{2}$ fathoms at low water, or lie aground alongside the quays.

The usual anchorage for ships of war, or vessels of large draught is in Carrick road, between St. Mawes and Falmouth banks. The distance between the black and white buoys of the Narrows at the southern entrance to the road is not more than $1\frac{1}{2}$ cables; it then gradually widens to $2\frac{3}{4}$ cables through the road, the distance increasing and decreasing through the Cross road toward St. Just pool.

The best anchorage in Carrick road is in its northern part, in from 13 to 15 fathoms, mud bottom. If the wind is east of South, bring up with port anchor in 12 or 13 fathoms rather inclined towards St. Mawes bank, and moor with starboard anchor towards Falmouth bank in 12 fathoms. Should the wind be west of South, bring up with starboard anchor

inclined towards Falmouth bank, and moor with port anchor towards St. Mawes bank. Keep the hawse open, for southerly winds throw in much sea.

Cross road and St. Just pool, though inconveniently far from Falmouth, afford better shelter and anchorage. Bring up in Cross road with either bower in 10 to 14 fathoms, mooring with open hawse to the westward.

TIDES.—In Falmouth harbour it is high water, full and change, at 4h. 57m.; springs rise 16 feet, and neaps 12 feet. The ebb sets out of the harbour, S.S.W. to the distance of a mile from the entrance, when it runs to the S.W., and farther off to the W.S.W. and W. by S. Off the Manacle rocks the stream runs to the westward nearly 3 hours after low water by the shore.

DIRECTIONS.—When bound to Falmouth from the westward at night, keep the Lizard lights open south of Beast point, W. $\frac{3}{4}$ N., until St. Anthony *fixed* light bears N.N.E.; then steer for the light on this bearing, and having passed about a quarter of a mile westward of St. Anthony point, a N. $\frac{1}{4}$ E. course for $1\frac{1}{2}$ miles will lead to Carrick road.

In the daytime Beast point kept open of Black head, W. by S. will lead three-quarters of a mile south of the Manacles. When St. Anthony lighthouse bears N.N.E. steer for it on that bearing, till Killiganon house comes on with Pennarrow or Mylor point N. $\frac{1}{4}$ E., which will lead through the eastern channel, and through the Narrows into Carrick road.

If desirous of anchoring in St. Just pool proceed on until Budock church comes over the rising ground of Trefusis point, or the tower of Meteorological observatory just open south of Falmouth church about W. by S.; either of these marks will lead through Cross road, until St. Kevern church comes over Pendennis point S.W., when anchor in St. Just pool in 12 to 15 fathoms mud.

If the weather be hazy and these marks cannot be seen, give St. Anthony point a berth of a quarter of a mile, and run in, keeping the land at St. Mawes about a point on the starboard bow, and then steer for Mylor point. Do not approach the land of St. Mawes nearer than 2 cables, nor St. Mawes bank within a depth of 9 or 8 fathoms. In beating in give the rocks off St. Anthony point a good berth, and if the ship is of large draught do not approach Black rock nearer than $1\frac{1}{2}$ cables.

Entering the harbour by the western channel, keep midway between Pendennis point and the 17 feet patch lying $1\frac{1}{2}$ cables S.W. $\frac{1}{2}$ S. from the beacon on the Black rock; and when the beacon and lighthouse are in line, steer for St. Mawes castle until Killiganon house comes on with Mylor point, N. $\frac{1}{4}$ E., when proceed as before.

To work out of this harbour large vessels should weigh on the latter

part of the flood, or a little before high water, and before half ebb they will be out of the harbour and half way to the Manacles. As the ebb sets to the westward towards Helford, a vessel when clear of the entrance should not stand farther westward than the meridian of Pendennis point, keeping the entrance open for the benefit of the harbour tide.

The COAST, from Zoze point on the eastern side of the entrance of Falmouth trends E. by N. $1\frac{1}{2}$ miles to Killygerran head, between which and Dodman point, which bears E. $\frac{1}{2}$ N. 8 miles, are two bights, named Gerran and Veryan bays, separated by Nare head, a bold headland 260 feet above high water.

Gerran bay, between Killygerran and Nare heads, is $3\frac{1}{2}$ miles wide and $1\frac{1}{2}$ miles deep, and the soundings from 15 fathoms in the offing gradually decrease to the shore. Gerran church stands on the western coast of the bay, and is conspicuous from the offing; the top of its spire being 254 feet above high water. From Killygerran head the cliffs are only 20 to 40 feet high as far as the eastern side of Pendowa beach at the head of Gerran bay, whence they gradually rise to Nare head; at low water the rocks dry a cable off shore.

Veryan bay, between Nare head and Dodman point, is $4\frac{3}{4}$ miles wide and $1\frac{1}{2}$ miles deep; the shore is clifty, from 20 to 200 feet high, and forms a number of bights. Dodman point is a prominent headland elevated 363 feet above the level of high water.

Bizzies Shoal.—Nearly a mile north-east of Killygerran head is Greeb point, off which shoal-water, with $3\frac{1}{2}$ to 7 fathoms, extends in a south-easterly direction nearly a mile, where it terminates in a shoal of $3\frac{1}{2}$ fathoms called the Bizzies, from which Trewince house is in line with the east end of Roseteage house bearing N.W., and the white coast-guard house in Veryan bay, is on with the south-east extreme of the Gull rock, N.E. by E. $\frac{3}{4}$ E.

Trewince house open west of Roseteage house N.W. $\frac{3}{4}$ N. leads westward of the Bizzies; the same house open east of Roseteage, N.W. by W. westerly, leads eastward; and the white coast-guard house open south-east of the Gull rock, N.E. by E. $\frac{1}{2}$ E., leads to the southward.

Gull Rock, elevated 125 feet above high water, lies 6 cables S.E. by E. of Nare head, and a quarter of a mile from the nearest shore. There is a clear passage between the rock and the land, the least water being 20 feet.

The Whelps, are detached rocks lying in a S.W. $\frac{1}{4}$ S. direction from the Gull rock. The outer and highest Whelp is distant 3 cables from the Gull, and covers at three-quarters flood; between it and the middle Whelp, which lies $1\frac{1}{2}$ cables from the Gull, there is a passage of $3\frac{1}{2}$ fathoms water; both rocks may be approached to half a cable's length. A small rock, which covers at a quarter flood, lies in a S.W. direction, distant

100 feet from the outer Whelp, and from it Pendowa lime-kiln is seen touching Nare head, bearing N.W. by N.

The above lime-kiln, open west of Nare head, N.N.W. $\frac{1}{2}$ W., leads westward of the Whelps; and Porth Looe flag-staff, open south-east of Gull rock, N.E. $\frac{1}{4}$ N., leads to the south-east.

Lath Rock.—Off the fishing village of Porth Looe, and about $1\frac{1}{2}$ miles E. $\frac{3}{4}$ N. from the Gull, is a small rock called the Lath, with only 7 feet over it, and deep water around. The rock lies with Gerran church in line with the extreme of Nare head, bearing West, and Porth Looe flag-staff N.N.W. $\frac{3}{4}$ W. Gerran church, appearing about half the distance between Nare head and Gull rock, W. $\frac{1}{4}$ N., leads south-east of the Lath; to pass in-shore of it, keep the church shut in with Nare head.

RIPPLINGS.—The soundings for the distance of a mile, S.W. by S. to S. by E. from Dodman point, are irregular, varying from 10 to $5\frac{1}{2}$ fathoms, and cause heavy overfalls in bad weather; it will therefore be prudent, when passing the point at that period, to give it a berth of 2 miles, where the sea will be regular and the depth 30 fathoms. The marks for the shoalest water, $5\frac{1}{2}$ fathoms, are Gerran church in line with the highest Whelp, W. $\frac{3}{4}$ N., and the flag-staff on Dodman point, N. by W.

The COAST from Dodman point trends $1\frac{1}{2}$ miles to the north-east to Lanledra point, and between is a bight, around which the cliffs are about 100 feet high. Lanledra point is only 20 feet high, and, extending $1\frac{1}{2}$ cables off it in an E. by S. direction, is a group of rocks called the Western Oar, which cover at a quarter flood; and hence the coast turns abruptly to the northward, forming a bight, and then eastward to Chapel point, which is low. In this bight the cliffs are high, sloping seaward, and in its western corner is a small sandy cove, called Gorran haven, having on its south-east side the remains of a pier.

From Chapel point the day mark on Gribbin head bears E. by N. $\frac{3}{4}$ N. distant 5 miles, and between are Mevagissey, St. Austell, and Tywardreath bays. Vessels will find good shelter from south-west gales in the bight of Mevagissey bay, in 7 to 10 fathoms, sandy bottom. They will also lie well sheltered in St. Austell bay, by anchoring in its southern part off Rope Hawne in 6 fathoms, stiff clay. Tywardreath bay affords shelter from easterly gales in 5 fathoms, sandy bottom, between Polkerris harbour and little Gribbin point.

The coast from Chapel point turns abruptly to the north-west, and at the distance of two-thirds of a mile is the sandy cove of Portmellin, in which there is a small fishery establishment; a quarter of a mile farther north is an inlet, at the head of which is the town and harbour of Mevagissey. Thence the coast trends in a north-east direction half

a mile to Pen-nare point, and then north the same distance to a sandy beach, which extends across a bight, in which is Pentuan tidal basin. The shore from Pentuan again becomes cliffy, and bends round to the eastward about $1\frac{1}{4}$ miles to Black head, which is bold and steep-to.

Gwineas Rock, lying E.N.E. 2 miles from Dodman point, and S. $\frac{1}{2}$ W. two-thirds of a mile from Chapel point, is elevated 26 feet above high-water springs, and appears black. At $1\frac{1}{2}$ cables S.E. by E. $\frac{1}{4}$ E. from the highest point of the Gwineas is the Yaw rock, which dries 3 feet at the lowest tides.

The passage between the Gwineas and Turbot point,—which is half a mile to the south-west of Chapel point,—is narrowed to one-third of a mile by a rocky patch of 11 feet water, lying S.S.E. a cable's length from Turbot point. The channel between this patch and Gwineas rock carries a depth of 5 to 7 fathoms.

MEVAGISSEY HARBOUR is formed by two piers, whose heads are 106 feet apart. Its area is about $3\frac{1}{2}$ acres, the quayage 230 yards, and there is one building yard. This harbour affords good shelter to vessels that can lie ground, but during south-east gales a great run sets in, causing them to strike heavily in taking the ground. The bottom dries $1\frac{1}{2}$ cables without the pier heads at the lowest tides. There are $14\frac{1}{2}$ feet in the centre of the harbour at high water springs, and 10 feet at neaps; at the entrance between the pier heads there are $15\frac{1}{2}$ feet at springs, and 11 feet at neaps. A large mackerel and pilchard fishery is carried on here during the season.

TIDES.—In Mevagissey harbour, it is high water, full and change, at 5h. 4m.; springs rise $15\frac{1}{2}$ feet, and neaps 12 feet.

PENTUAN TIDAL BASIN is on the eastern side of the beach at three-quarters of a mile northward of Pen-nare point. The entrance is secured by gates 28 feet wide, the sill of which is $2\frac{1}{2}$ feet above low-water ordinary springs. These gates are protected from the southward by a pier running off about 177 yards from them in a south-east direction, and they are farther secured by balks of timber, during south-east gales. The basin has 300 yards length of quays, and carries 14 feet at high-water springs, and 10 feet at neaps.

The sand dries out upwards of a cable's length from the entrance at low water, and during south-east gales the water on the bar varies from 3 to 4 feet. A vessel should never attempt to run for the harbour at this period, or with a ground swell on, or with a gale blowing on the land. A warping buoy is moored in $11\frac{1}{2}$ feet at low tide about $1\frac{1}{2}$ cables S.E. from the end of the pier.

The exports from this place are china clay, and granite. There is a railway about 4 miles in length connecting it with St. Austell.

CHARLESTOWN HARBOUR, formed by two piers in the northern part of St. Austell bay, is capable of accommodating 15 vessels of 150 to 200 tons burthen, but, like Pentuan, it would not be prudent to run for it with a ground swell on, or with a gale blowing on the land. At its head there is a small tidal basin three-quarters of an acre in extent, secured by gates 27 feet wide. The harbour is one acre in extent, 53 feet wide between pier heads, has 317 yards length of quayage, and dries out 200 feet from the entrance at the lowest tides. There are 14 feet between the pier heads and over sill of basin at high water springs, and 10 feet at neaps.

Two warping buoys are moored $1\frac{1}{2}$ cables outside the entrance of the harbour; one in 8 feet at low water S.E. by S., and the other in 10 feet S. $\frac{1}{2}$ W. from the entrance.

PAR HARBOUR is formed in the north-east part of Tywardreath bay by two piers, the outer one of which runs off 347 yards in an easterly direction from the land and protects the harbour from the sea with southerly winds. The entrance between the piers is 125 feet wide, and in it there are 14 feet at high-water springs, and 10 feet at neaps, which depths continue all through the channel of the harbour along the inner pier, alongside which there is space to berth 30 vessels of 100 to 200 tons burthen.

The area of the harbour is $26\frac{1}{4}$ acres and the length of quayage 557 yards. The sand dries $1\frac{3}{4}$ cables S.S.W. from the entrance at the lowest tides, also out to the Callyvardor rocks, which lie S. by E. $\frac{1}{4}$ E. one-third of a mile from the outer pier end; these rocks have an iron beacon erected on their west extreme, are 500 feet in extent, and cover at a third flood. An active pilchard fishery is carried on at Par during the season, and a great quantity of china clay, copper, iron, and tin ore is shipped to Swansea and the potteries.

POLKERRIS HARBOUR is also in Tywardreath bay, S.E. three-quarters of a mile from the entrance of Par. It is only a quarter of an acre in extent and open to the westward, but it is sheltered from that quarter by a pier, which extends 100 yards from its south side, curving to the northward; the length of quayage is 70 yards. The bottom dries out 30 yards from the pier at the lowest tides, and the tide rises in the harbour about $14\frac{1}{2}$ feet at high water springs, and 10 feet at neaps.

GRIBBIN HEAD may be easily recognized by its day mark, a square beacon tower 84 feet high, with red and white horizontal stripes, and standing on an elevation 250 feet above high water. The head is bordered by rocks

on which the sea breaks heavily in bad weather. At a quarter of a mile from the nearest shore, and in a S.E. $\frac{1}{2}$ E. direction from the beacon, is Cannis rock, which covers at three-quarters flood; between it and the land there is a narrow passage with 9 feet water. Little Gribbin point, the south-east extreme of Tywardreath bay, has rocks extending nearly a cable's length off it.

FOWEY HARBOUR is at the entrance of the river Lostwithiel, which trends to the northward, and is navigable at high water for $5\frac{1}{2}$ miles towards the town of Lostwithiel. The entrance, which is about 10 miles E.N.E. of Dodman point and $1\frac{1}{2}$ miles eastward of the beacon on Gribbin head, is little more than a cable wide, and may be easily recognized by the high land on either side, and more particularly by the ruins of St. Saviours church on the eastern side, and the old mill on the high ground on the western side; the church stands on an elevation of 195 feet, and the mill 245 feet above high water springs. The town of Fowey stands on the right bank of the river, half a mile within the entrance; and the village of Polruan in a small bight, just within the eastern point of entrance. The shores are well wooded for a long distance above the town.*

The ingress and egress of this harbour being in a N.E. by E. and S.W. by W. direction, gives it an advantage over many along the coast, as outward bound vessels can leave it with a S. by E. wind, and coasters, whether bound up or down channel, that get embayed between Dodman point and the Rame head during a heavy southerly gale may run for it even with the loss of anchors; for having passed the eastern point of entrance and rounded Polruan point, they may safely run on the bar, which has from 3 to 5 feet water at the lowest tides, and being composed of soft mud, no harm can ensue. From this position vessels will be released by the flowing tide, and can run as far up as convenient.

There is space sufficient for four vessels of 16 feet draught and of moderate length to moor in Polruan pool, a quarter of a mile within the entrance; and although it appears on the chart to be exposed to south-west gales, it is not so, there being no swell between the entrance points. Thirty vessels of 18 feet draught and moderate length may also lie moored above the bar quite land-locked. In 1866 there belonged to the port 181 sailing vessels, representing 16,014 tons.

Life Boat.—A life boat is stationed at Fowey, which is also a coast-guard station.

TIDES.—In Fowey harbour it is high water, full and change, at 5h. 14m.; springs rise 15 feet, and neaps $11\frac{3}{4}$ feet.

* See Admiralty Plan of Fowey Harbour, No. 31; scale, $m = 16$ inches.

DIRECTIONS.—Approaching Fowey from the westward, in order to clear the Cannis rock off Gribbin head, keep Dodman point on a W. by S. $\frac{1}{2}$ S. bearing, and showing south of the Gwineas rock, until the beacon on Gribbin head comes in line with the coast-guard flagstaff, N. by W. $\frac{1}{4}$ W., or Fowey church tower is in line with St. Catherine point, N.E. by E.; then bring the church tower in line with White House point, N.E. $\frac{1}{2}$ E., which mark will lead mid-way between the entrance points to an anchorage in Polruan pool.

Coming from the eastward, steer parallel with the shore, about the distance of a mile, until Fowey church tower is in line with White House point, when proceed as before. There is no danger off either point of entrance but what is visible, except Mundy rock, which lies a cable within the entrance on the western side, with 5 feet on it at the lowest tides.

In the roadstead outside the entrance there is good anchorage in from 5 to 8 fathoms, sandy bottom, with Fowey church showing over St. Saviours point, and the points to the eastward open.

The COAST from Fowey trends in an E.S.E. direction nearly 4 miles to Nealand point, and between are Lantic and Lantivet bays, separated by Pencarro head, elevated 265 feet above high water; the cliffs vary from 50 to 300 feet in height, and the rocks uncover nearly a cable off shore. The Udder rock lies half a mile off the eastern shore of Lantivet bay, and uncovers 2 feet at the lowest tides. The northern extreme of Looe island in line with Orestone rock bearing East, or the coast-guard flag-staff at Polperro in line with the cliffs bearing East, will lead half a mile south of Udder rock; and a vessel will be eastward or westward of it, when the beacon on the shore abreast the rock is east or west of Shag rock.

From Nealand point, which is remarkable from its overhanging cliff, the coast trends $1\frac{1}{2}$ miles eastward to Downend point, and the rocks extend a cable off shore. A quarter of a mile off the latter point are Downend shoals, with 2 fathoms water over them; and thence the coast runs first to the north-east, and then bends to the south-east to Orestone point, forming Talland bay, which is a mile wide, and bordered by a number of rocky islets from 30 to 60 feet high.

From Orestone point the shore trends N.N.E. nearly half a mile, with cliffs from 30 to 60 feet high; and thence becoming much lower, runs nearly east, and, at low water springs, is nearly connected with Looe island by flat shelving rocks. Looe island, half a mile in circumference, and elevated 145 feet above high water, has off its south-east extreme the Rennies rocks, which extend upwards of a quarter of a mile in that direction from the point, and cover at quarter flood.

Larriek Rock lies West $1\frac{1}{2}$ cables from Nealand point, and covers at last quarter flood. The Shag rock kept open of Lyson point, N.W., will

lead south of the Larrick; so will also the Black Bottle rock open of Pencarro head N.W. by W. $\frac{3}{4}$ W.

POLPERRO HARBOUR.—At a mile eastward of Nealand point is the mouth of a little inlet 160 feet wide, and at its head is the tidal harbour of Polperro, in which the mackerel and pilchard fishery is carried on to some extent. The harbour, formed by an outer and inner pier, is 3 acres in extent, and the tide rises 11 feet at springs, and 5 feet at neaps; the entrance, between the outer pier head and the shore, is 54 feet wide.

The sand dries from one to 2 feet at the lowest tides to a distance of 150 feet beyond the outer pier, but outside this the depth gradually increases to 20 feet. There is a rocky patch of 9 feet water lying nearly in mid-channel, at the mouth of the inlet, and another, called the Polca, of 4 feet, half a cable south of the patch.

LOOE HARBOUR and ROAD.—The entrance to this little tidal harbour is distant 9 miles N.W. $\frac{1}{2}$ W. from Rame head, and three-quarters of a mile N.N.E. from Looe island. A jetty runs out 167 yards in a south-east direction from the eastern point of entrance, and from its extreme end to the western shore the entrance is 150 feet across; at the lowest tides the bottom dries 67 yards outside the jetty. There are 12 to 16 feet in the harbour at high-water springs, and 9 to 13 feet at neaps. At the east quay there are 12 feet at high-water springs, and 10 feet at the west quay; at neaps there are 9 feet at east quay and 7 feet at west quay. Two warping buoys are moored $1\frac{1}{2}$ and 3 cables respectively, in a south-east direction from the end of the jetty.*

The town of Looe is picturesquely situated, and divided by the river into two parts, named East Looe and West Looe. The river, above the town, was long spanned by an antique narrow bridge of 15 arches, but that has been replaced by a stone structure of 8 arches. There is a considerable export of copper ore and granite, and during the season the pilchard fishery is actively pursued.

The roadstead off Looe harbour affords good shelter from westerly winds, and is only open from S. by W., to S.E. by E. The best position is in 4 to 8 fathoms, mud bottom, with the summit of Looe island bearing from West to S.W. by W., and the tower of East Looe church well open of the western point of entrance of the harbour. Vessels of light draught can anchor in less water, farther in over sandy bottom, with East Looe church N.N.W. $\frac{1}{2}$ W.

Life Boat.—A life boat is stationed at Looe, which is also a coast-guard station.

TIDES.—It is high water, full and change, at East Looe, at 5h. 26m.; springs rise 16 feet, and neaps 13 feet.

* See Admiralty Plan of Looe Harbour, No. 1,914; scale, $m = 20$ inches.

DIRECTIONS.—Approaching Looe road from the westward, the beacon on Gribbin head in line with Nealand point, W. by N. $\frac{3}{4}$ N., will lead a quarter of a mile south of the Rennies rocks, which extend from the south-east end of Looe island—the slated store-house on Downend point just open south of the Orestone, W.N.W., will also lead a cable south of them—and when the tower of East Looe church is well open of the western point of entrance of the harbour, N. $\frac{1}{4}$ W., steer N.N.E. for the anchorage.

The passage between Looe island and the main nearly dries at low-water springs, but at most other times there is a channel for boats and small coasters. To run through from the eastward, keep Dodman point just showing clear of Orestone rock, W. $\frac{1}{2}$ S., and when the summit of the island bears S.E., haul to the south-westward to avoid the Kimlers rocks, which cover at a quarter flood.

Sherbeterry Rocks.—The coast from the entrance of Looe harbour trends E. by S. $\frac{3}{4}$ S. $4\frac{1}{4}$ miles to Longstone rock, which lies close to the land, and is elevated 59 feet above high water springs. The cliffs along this portion of coast are from 60 to 300 feet high, and the outlying rocks extend in some places upwards of 2 cables off shore.

At $2\frac{1}{2}$ miles from Looe is Seaton beach, and off it are several rocky patches of $4\frac{1}{2}$ fathoms water, the outer one of which, named Sherbeterry rocks, is distant 2 miles from the beach. From this outer patch the beacon on Gribbin head is open of Nealand point, W. by N. $\frac{3}{4}$ N., and an old public house is in line with a long hedge N. by E. $\frac{1}{4}$ E. The Mewstone on with the extreme of Rame head bearing S.E. by E. $\frac{3}{4}$ E. leads three-quarters of a mile south of Sherbeterry rocks, and clear of all danger between Rame head and Polperro.

PORT WRINKLE.—At three-quarters of a mile eastward of the Longstone rock is a small bight, at the head of which is the little pier harbour of Port Wrinkle, which has an area of three-quarters of an acre, and affords shelter for fishing boats. It had formerly two piers, but in 1824 the eastern one was washed down.

There are two channels into this harbour between the rocks, which from the Longstone extend $1\frac{3}{4}$ cable from the base of the cliffs; the outer rock, named the Brawn, lies that distance S.S.W. from the pier end, and covers at half flood. To facilitate the navigation of these channels three beacons are erected on the cliffs 400 feet northward of the harbour, and lanterns are placed in them at night if the boats are at sea. The two western beacons in one N.E., lead through the eastern channel, and the east and west beacons in one E.N.E., through the western channel.

WHITESAND BAY.—From Port Wrinkle the coast bends round to the south-east $4\frac{1}{2}$ miles to Rame head, forming Whitesand bay, which is exposed to the whole force of south-westerly gales. The coast is high and rugged, the cliffs varying from 100 to 250 feet in height, and is bordered by alternate patches of sand and rock, which extend upwards of a cable from the foot of the cliffs; and thence the soundings increase gradually seaward, but vessels should not approach within the depth of 6 or 7 fathoms at low tide.

Coasters will find good anchorage with off shore winds in the bight in the south-east corner of this bay, in $3\frac{1}{2}$ to 4 fathoms, sandy bottom, with the two western points of the promontory of Rame head in one, S. S. W. $\frac{1}{2}$ W. At the distance of a cable from the northern of these points, and lying with the coast-guard house in the bight touching the high-water mark of the point, is a detached rock called the Pader, which covers at a quarter flood. There are also detached rocks, awash at low water springs, lying the same distance off the southern of these points.

TIDES.—At Dodman point, and off the entrance of Mevagissey, Charlestown, Pentuan, Par, Polkerris, and Polperro harbours it is high water, full and change, at about 5h. 4m.; springs rise $15\frac{1}{2}$ feet, and neaps 12 feet.

EDDYSTONE ROCK and LIGHT.—The Eddystone rock is awash at high-water ordinary springs. Its north-west side is clear of danger, and there are 10 fathoms water a third of a cable from the lighthouse; but the other sides are foul, particularly the north-east side, which should not be approached within a quarter of a mile. A small patch called N.E. rock lies E. by N. $1\frac{1}{2}$ cables from the lighthouse, and uncovers 2 feet at low water springs; at half a cable to the N.N.E. the depth is only $3\frac{1}{2}$ fathoms. The other dangers extend respectively S.W. $\frac{1}{4}$ W. 240 feet, S. by W. 500 feet, and S.E. $\frac{3}{4}$ E. 490 feet from the lighthouse, and the rocks at their extremes uncover from 3 to 7 feet; close outside them the depths are from 8 to 12 fathoms.

The lighthouse stands on Eddystone rock, and is distant $38\frac{1}{2}$ miles E. $\frac{1}{4}$ S. from the Lizard; $8\frac{1}{2}$ miles S.W. $\frac{1}{4}$ S. from Penlee point; and 18 miles W. by N. $\frac{3}{4}$ N. from Bolt head. The lighthouse, 89 feet high from base to vane, is built of granite, and painted red and white in alternate horizontal bands; it exhibits from an elevation of 72 feet above the level of high water a *fixed* white light, which should be seen in clear weather, from a distance of 13 miles.

Hand Deeps is the name given to a bed of sunken rocks lying N.W. $\frac{3}{4}$ N. $3\frac{1}{2}$ miles from the Eddystone lighthouse, and nearly in the track of vessels

bound from the westward for Plymouth. They are composed of rocky pinnacles, on the highest of which are only 4 fathoms at low water springs, and therefore should be studiously avoided by vessels of large draught in a high sea or a long swell. In bad weather the position of the shoal is shown by a short breaking sea in its vicinity, and in fine weather by tide riplings.

From the centre of the Hand Deep, the white signal-house on the high land in the rear of Rame head is seen westward of the chapel on the head, N.E. by E. $\frac{1}{4}$ E.; Earl Morley's park gate-way is wholly in view eastward of the high land of Penlee, or mount Batten round tower is in line with Penlee point; and the eastern part of the Moor hills is in line with the sharp top of the Mewstone, E. $\frac{3}{4}$ N.

The lighthouse on Plymouth breakwater in line with Penlee point, E. by N. $\frac{1}{2}$ N., leads upwards of a mile north-westward of the rocks; and the lighthouse on with mount Batten tower, N.E. by E. $\frac{1}{4}$ E., leads the same distance to the south-eastward.

East Ratts is the name given to a cluster of rocks, 2 cables long in a N.W. direction and a cable wide, with only 5 fathoms water, and 10 to 19 fathoms close around. They lie 5 miles from the nearest land (Bolt tail), and in the fairway of vessels bound to Plymouth from the eastward, with the first rise in the land within Prawl point seen half way down the Bolt head bearing S.E. by E. $\frac{1}{4}$ E.; Bigbury church spire over the right extreme of the sandy beach in Challaboro cove, N.E. by E. $\frac{3}{4}$ E.; the Mewstone N. by W. $\frac{3}{4}$ W. 7 miles; Bolt head S. E. by E. $\frac{1}{2}$ E., nearly the same distance; and the Eddystone W. by N. $11\frac{1}{4}$ miles.

The peak of the Mewstone in line with Maker tower N. N. W. $\frac{1}{2}$ W. leads nearly a mile eastward of the rocks; and the same peak in one with Stoke block-house and the fall of the land at Reny and Staddon points, leads 2 miles westward.

PLYMOUTH SOUND.—From Rame head the Mewstone bears S.E. by E. $\frac{1}{2}$ E., $4\frac{1}{4}$ miles, and between them is the entrance to Plymouth sound, which is protected from south-west gales by a magnificent breakwater thrown across the entrance. Rame head, 335 feet high, with a small ruined chapel on its summit, is the extremity of the promontory which constitutes the western boundary of the sound, and, when viewed from the southward, assumes a conical form.*

The land in the neighbourhood of the Sound is easily recognized by many conspicuous objects, including the turreted beacon-tower on Penlee heights, 351 feet high; the spire-steeple of Rame church; the high wall of the Rifle butt on Staddon heights; the Breakwater and its lighthouse; the large

* See Admiralty Plan of Plymouth Sound and Hamoaze, No. 30; scale, $m=6$ inches.

towns and forts built round the Sound; as well as the Great and Little Mewstones.

Plymouth and the adjoining towns of Stonehouse and Devonport, with their large suburbs, are built at the head of the sound, and together form one of the most flourishing places in the west of England. In 1861 the population of Plymouth amounted to 62,823, Devonport to 50,504, and Stonehouse to 14,294. In the year 1866 there belonged to the port 416 sailing vessels, representing 47,796 tons, and 13 small steamers.

There are large sugar refineries, also soap, starch, and lead factories, with several paper mills, in the neighbourhood. The rivers and railroads from Plymouth communicate with an extensive mining district. There are 32 Trinity House pilots belonging to the port, and their limits are from the Start to Looe.

The Mewstones, two in number, are generally known as Great and Little. The Great Mewstone is a precipitous rocky islet, with scanty vegetation and a sharp apex, 194 feet high and $1\frac{1}{2}$ cables in length, lying about half a mile S.S.W. of Wembury point, but the passage is so filled with rocky ledges, as to leave only a narrow channel available for boats. The Little Mewstone, 48 feet high, is a dark rock, about 100 yards to the south-westward of the Great Mewstone, and both objects form admirable landmarks.

ANCHORAGE.—Cawsand bay, on the west shore of the Sound, affords good anchorage to vessels bound down channel and detained by westerly winds, being sheltered from S.W. $\frac{3}{4}$ W., round by west and north, to S.E. by E. $\frac{1}{2}$ E. They should anchor south of the line of the central division of the Breakwater; to the northward of this the ground is rocky. If of large draught, keep Drakes island open of Redding point, and anchor abreast the village of Cawsand, in 5 to 7 fathoms water, over fine sand, mud, and small shells. Smaller vessels will find the soundings regular, with sandy bottom as they approach the shore. Water and the usual supplies can be obtained at the large villages of Kingsand and Cawsand.

The best anchorage in Plymouth sound is comprised within the triangle formed by the following intersections: Penlee point in line with the west end of the Breakwater; the centre of Cawsand in line with the west end of the Breakwater; and St. Johns church, Plymouth, in line with the west extreme of Mount Batten. In this space there are from 30 to 45 feet at low-water springs, over soft mud. By Admiralty regulations Her Majesty's ships are required to occupy the anchorage ground near the Breakwater; and merchant vessels are to anchor in the north-east part of the sound. This latter anchorage is limited to the southward, by the two whitewashed marks on Rams Cliff point in one, bearing S.E. by E. $\frac{3}{4}$ E.; and to the

westward by the Hoe obelisk, and east end of Windsor terrace in line, N. by E. $\frac{1}{2}$ E.

Small vessels frequently anchor on the flat north of Drakes island, in from 3 to 8 fathoms water, over mud, sand, and gravel; but to the westward of the line between the Asia and Melampus buoys, and to the southward of transporting buoys on the north side of Drakes island.

Moorings for one ship of moderate length is laid down in Barn pool, on the west side of the passage into Hamoaze.

HARBOURS.—Plymouth is generally considered as one of the most capacious and secure rendezvous in Great Britain. It possesses two good harbours, Hamoaze and Catwater, between which are three inlets, viz., Stonehouse pool, Mill bay, and Sutton pool, each about one-third of a mile in length. Catwater, Sutton pool, and Stonehouse pool, are chiefly resorted to by merchant vessels and foreigners, Hamoaze being reserved for Her Majesty's ships.

CATWATER forms the entrance to the river Plym, and is a well-sheltered harbour 190 acres in area, with a general depth of from 2 to 3 fathoms; there is a narrow channel of $3\frac{1}{2}$ fathoms leading to a deep hole near the Turn-chapel rock, where moorings are laid down, and 16 large ships can moor in tiers, at low water. There are three building yards, two patent slips, and a dry dock on its shores; the latter is 190 feet long, 57 broad, 45 feet wide at entrance, 14 feet over sill at high water springs, and $9\frac{1}{2}$ feet at neaps.

SUTTON POOL, at one-third up from its entrance, is enclosed by piers. Between the pier-heads the width is 350 feet, and the depth 22 feet at high water springs. On the east pier-head is a self registering tide-gauge, over which is a dial-plate, which shows at all times the actual depth of water between the pier-heads. Within the pier-heads there are not more than 6 feet at low water, and the greater part, consisting of soft mud, dries. There are three building yards, two patent slips, and a dry dock on the shores of the pool; the latter is 265 feet long, 54 broad, 50 feet wide at entrance, 16 feet over sills at high water springs, and $11\frac{1}{2}$ feet at neaps.

LIGHT.—A white gas light, visible at 5 miles, is exhibited 25 feet above high water on the west pier head of Sutton pool. This light is larger and brighter than any of the town lights. Red gas lights are shown at most of the principal landing places in the harbours.

MILL BAY has a wet and dry dock and tidal basin. The wet dock is 1,260 feet long, 450 feet broad, 80 feet wide at entrance, 31 feet over sill at high water springs, and $26\frac{1}{2}$ feet at neaps. The dry dock is within the wet dock, and is 367 feet long, 92 feet broad, 80 feet wide at entrance, $27\frac{1}{2}$ feet over sill at springs, and 23 at neaps. The tidal basin,

at entrance of wet dock, is protected by a pier from the east point of entrance, within which is a pontoon pier for the accommodation of steam vessels; it has an area of 30 acres, with from $2\frac{1}{4}$ to 14 fathoms in it at high water springs, and $1\frac{3}{4}$ to $12\frac{1}{2}$ fathoms at neaps.

LIGHT.—At Mill bay there is a red light on the pier head, and a green light on the pontoon; these lights in line will clear the *Melampus* shoal.

STONEHOUSE POOL lies between the towns of Stonehouse and Devonport, and at its entrance, off the victualling yard, there are from 5 to 20 fathoms at high water; a short distance farther up the muddy bottom dries at low tide. There are two building yards in this pool.

HAMOAZE is formed at the mouth of the river Tamar, between Mount Edgcumbe and Albert bridge at Saltash, and its deep water space is fully taken up with moorings for Her Majesty's ships. Its entrance is somewhat contracted and circuitous, but it contains space sufficient for 100 sail of the line at moorings, independent of anchorage for small vessels, in moderate depth of water, good holding ground, and well sheltered from wind and sea. At the quays of Devonport, and in the rivers and creeks that have their outlet in Hamoaze, a considerable coasting trade is carried on for the supply of this populous neighbourhood, and for exporting the mining produce of the surrounding country.

DOCK and STEAM YARDS.—Her Majesty's dockyard, gun wharf, and Keyham steam yard, are on the eastern shore of Hamoaze, their water frontage occupying an extent of about 7,000 feet. The dockyard has an area of $71\frac{1}{2}$ acres, and from its south end it extends in a circular sweep to the northward as far as the gun wharf, which separates it from Keyham yard, with which, however, it is connected by a tunnel. A camber and boat pond nearly divide it into two parts, in the northern of which, facing the harbour, are three dry docks, $263\frac{1}{2}$, $209\frac{1}{2}$, and $415\frac{1}{2}$ feet respectively in length on blocks, 64, $56\frac{1}{2}$, and 73 feet wide between gates, and $20\frac{1}{2}$, 20, and 31 feet over sill at high water springs; a basin 300 feet long, 230 feet wide, and 31 feet over sill, and at its head is another dry dock 266 feet long on blocks, 65 feet wide between gates, and $28\frac{1}{2}$ feet over sill. There is also a graving slip 169 feet long, and 62 feet wide.

In the southern part of the dockyard are three building slips, $253\frac{1}{2}$, 266, and $323\frac{1}{2}$ feet respectively in length on blocks, and 52, $52\frac{1}{2}$, and $53\frac{1}{2}$ feet in breadth; two slips for small vessels; an outer and inner mast pond, mast houses, &c., and the finest ropery in the kingdom.

The gunwharf is separated from the dockyard by a portion of the town called Cornwall street; it covers about 10 acres of land, and besides the depositories for gun carriages, and the implements of the field train, there are piles of ordinance and shot belonging to the ships in the harbour. Between it and Keyham yard is the Ferry road, connected with Tor-

point by a steam bridge, and some private quays and canals occupying a water frontage of about 1,000 feet.

Keyham steam yard has an area of 73 acres exclusive of ground north of Keyham, and that part of mud flat filled up with surplus excavation from the dock and basin, and now appropriated as a timber park covering an area of 22 acres.

Keyham yard proper comprises two floating basins, one boat basin, and three dry docks ; a covered area of about 7 acres for steam machinery, foundry, boiler-house, smithery, store-houses, and work-shops, as well as coal stores, work-sheds, two pumping-engine and boiler-houses belonging to the shipwright department.

The basins and docks are constructed of Cornish granite backed with limestone, and around them are three large sheers, with machinery capable of lifting from 40 to 100 tons, besides 13 others with lifting powers varying from 5 to 40 tons. Hydraulic and steam capstans are provided round the basins and docks.

The south basin of 7 acres area has 29 feet in it at high water springs, and can be pumped up to 32 feet. It is entered from Hamoaze by a lock 80 feet wide, with $33\frac{1}{2}$ feet over sill of caisson at high water springs. In its eastern part are three dry docks, the entrances of which, 80 feet wide, are closed by wrought-iron caissons.

The docks are 413, 278, and 347 feet in length respectively, on blocks from bilge of caisson. The North or Queen's dock has 27 feet over sill, and can be pumped up to 3 feet more. The Middle dock 23 feet, and South dock 26 feet over sill, with the addition of 3 feet rise by new pumping power.

The North basin, over 9 acres in area, has 32 feet water at high water springs, and this depth can be increased 3 feet. It has two entrances, 80 feet wide from the Hamoaze ; the one from the north with a depth of 32 feet over sill at high water springs, and the other from the south with a depth of 25 feet over sill, can be raised to 28 feet if necessary. Each entrance is closed by caissons raised and sunk by air chambers and water ballast.

A boat basin, 300 feet long, and 92 feet average width, has been completed at north-west end of yard, with an entrance from Hamoaze 30 feet wide, and approachable at all times of tide.

A branch Railway line, three-fourths of a mile long, connects the Cornwall railway with Keyham yard, and thus communication with the railway system and other naval Government establishments is effected.

The Royal William victualling yard, 17 acres in area, occupies a tongue of land on the eastern side of the entrance of the harbour, and

consists of a quadrangular pile of buildings and spacious quays, fronted by a sea wall about 1,600 feet in length. In the middle of the wall facing Stonehouse pool is the entrance to a basin, about an acre in area, and closed by a boom. On the summit of an adjoining eminence is a stone reservoir supplied from the Plymouth leat, and calculated to contain 6,000 tons.

BREAKWATER.—This magnificent structure for the protection of the Sound was commenced in 1812. Its western extremity is distant about 2 cables to the northward of the shoal of the Panther; and thence it extends towards Bovisand bay, directly across the shoal of the Shovel, and its eastern end terminates in the vicinity of Staddon point, from which it is distant about $3\frac{1}{2}$ cables. The central division of the Breakwater is 1,000 yards long, N. 86° W., and S. 86° E. (true); and from each end an arm projects 350 yards, at an angle of 14° to the northward of the central division, thus shutting in that part of the Sound which lies south-eastward of a line between Penlee and Dunstone points.

The Breakwater is constructed of granite and limestone, brought from the quarries at Oreston, on the east shore of Catwater. The body of the work is of rubble masonry; but from low-water line, on each side, to the top, the surface stones are dressed and laid in Roman cement, and have on the outer face a slope of one to 5, and on the inner face a slope of one to 2. Below low-water line the slope has been formed by the action of the waves, and the general average is that of one to 2. A stone lighthouse, 76 feet high, is erected on its western end, and on its eastern end is a conical beacon, bearing a mast with a ball on summit. The mast has steps, and the ball is fitted to receive within it six men, in case of shipwreck.

LIGHTS.—The lighthouse on the western end of the Breakwater exhibits from an elevation of 63 feet above high water, a *fixed* light of the second order, which shows *red* seaward—or in the direction of Staddon point, which bears from it E. by S. $\frac{1}{2}$ S., thence round by the south and west through Cawsand bay and up the Sound to the direction of the Melampus buoy, which bears from it N.E. $\frac{1}{2}$ E.—but it shows *white* as soon as it bears S.W. $\frac{1}{2}$ W., and over all the anchorage ground within the breakwater; and no vessel should anchor till the light changes from red to white. The light is elevated 63 feet above the level of high water springs, and is visible in clear weather from a distance of 9 miles. A bell is sounded in foggy weather.

A *fixed* white light is also shown in the Breakwater lighthouse, 15 feet below the above red light, to serve as a leading light to guide vessels more effectually by night in entering Plymouth Sound by the western channel. It will become visible immediately upon passing the chequered buoy of the

Draystone from the westward, and the black buoy of the Knap from the eastward, and is so placed that it can be seen only between the bearings of N.E. by E. $\frac{3}{4}$ E. and N.E. $\frac{1}{2}$ E., or over an arc of 12° . When seen the channel is open, and vessels may run direct for the light, giving it a berth of about a cable's length in rounding the Breakwater.

BREAKWATER FORT.—A fort is in course of erection inside the breakwater, off the middle of the central arm; the fort is elliptical in form, with its major axis, 150 feet long, parallel to the line of the breakwater, and distant from the nearest part of the landing place pier 79 yards, the depth of water between being $4\frac{1}{2}$ fathoms.

TIME SIGNAL.—Greenwich mean time is daily shown at 1 o'clock p.m. by the instantaneous collapse of a cone suspended near the top of the flagstaff in the redoubt on Mount Wise, Devonport. When not in use, the cone hangs in a closed state on the flagstaff.

As a preparatory notice, the cone is extended to its perfect shape, at 3 minutes before 1 o'clock, and at the instant of 1h. p.m. of Greenwich mean time it collapses. Again, at 2 minutes later it is once more extended, and at the instant of 1h. 5m. p.m. it again collapses. The second collapse is made in order to verify the first, or in the event of its not having been noted by the observer. The time signal is not made on Sundays.

The cone is of canvas $4\frac{1}{2}$ feet in diameter, and painted black. It is suspended below the flag on the flagstaff, at an elevation of 175 feet above the mean level of the sea. Its collapse may be seen in clear weather with a glass at a considerable distance outside the Breakwater when bearing between N. by W. and N. by E.

Mount Wise may be known by its southern green slope; also from its proximity to St. Stephens church, which has a remarkably sharp spire. The position of the flagstaff on the Mount is lat. $50^{\circ} 22' N.$, long. $4^{\circ} 10' 15''$, or 16m. 4ls. West of Greenwich.

DANGERS OUTSIDE THE BREAKWATER.

The dangers at the entrance of Plymouth Sound, outside the Breakwater, are: on the western side, the Draystone; in the centre, the Knap, Panther, Tinker, and, for large ships, some patches of rocky ground lying off the east end of the Breakwater; and on the eastern side, the reef off the Mewstone, with the Shagstone, and the rocks in its vicinity.

Draystone Reef, projecting nearly a quarter of a mile in a southeasterly direction from Penlee point, is marked by a chequered red and white buoy moored in 5 fathoms on its outer extremity, with Rame head coast-guard mast on with the north side of a remarkable gap in the cliff in

Lillery cove, N.W. by $\frac{1}{2}$ W.; the west side of the third fish store from the northward in Cawsand bay, on with Penlee high-water point, N. $\frac{3}{4}$ E.; and west end of Harbour Master's house, on with high-water mark of Redding point.

Should the buoy be adrift, do not stand nearer the reef than to bring the tall sharp spire of Roman Catholic church, open of Redding point N.E. $\frac{1}{4}$ N.; this leads eastward of the Draystone, over which, at low water, there is only a depth of 11 feet, though between it and the point the water deepens to 19 feet.

Knap and Panther Shoals constitute nearly one continued shoal of sand and rock, having only 20 and 22 feet at low water over their shoalest heads, with casts of 5 to 7 fathoms between. The two shoals combined are upwards of one-third of a mile in length S.W. by W. $\frac{1}{2}$ W., and from the outer and shoalest spot on the Knap, with 20 feet water, the Breakwater lighthouse is distant half a mile N.E. $\frac{1}{4}$ E. The passage between the lighthouse and the inner end of the Panther, with 22 feet, is 2 cables broad, with from 6 to 9 fathoms water, and may occasionally be useful. The leading mark through is, the Shagstone in line with northern high-water of Mewstone S.S.E. $\frac{3}{4}$ E.; the same mark will also lead north of the Tinker, in not less than 4 fathoms.

The inner and outer end of this compound shoal is marked by a black buoy. The Panther buoy, on the north end of the shoal, lies in 7 fathoms water, with Mount Wise flag-staff in line with west extreme of the Breakwater platform, N. $\frac{3}{4}$ E.; the Breakwater beacon midway between Bovisand house and Bovisand cottages, E. by S. $\frac{1}{4}$ S.; and the Shagstone its own breadth open northward of the Mewstone, S.E. by S., southerly.

The Knap buoy, on the south end of the shoal, lies in 6 fathoms, with the blockhouse on Devils point just open eastward of Ravenness point, N. by E. $\frac{3}{4}$ E.; and the Breakwater beacon on with the south end of Bovisand coast-guard houses, E. $\frac{1}{4}$ S.

Tinker Shoal.—The centre of this shoal lies about three-quarters of a mile S.E. by S. from the east end of the Breakwater, is a quarter of a mile in length, east and west, one-eighth of a mile in breadth, and has from 15 to 20 feet water.

Each end of this shoal is marked by a white buoy. The western buoy is placed at the north-west angle of the shoal, in 6 fathoms, with the dock-yard chapel in line with Ravenness point, N. $\frac{1}{4}$ W.; the Breakwater beacon on with the east end of Catdown quarry cliff, N.E. $\frac{1}{4}$ N.; and the highest peak of Reny rock on with the right extreme of a small dark quarry on Wembury point, S.E. by E.

The eastern buoy lies at the south-east angle of the shoal in 5 fathoms, with the Breakwater lighthouse on with the east turret of Picklecombe

fort, N. by W. $\frac{3}{4}$ W. ; the house in Staddon high north battery on with the inner part of curve of Bovisand pier head, N.E. ; and the highest part of Reny rock on with the centre of Wembury point quarry, S.E. by E.

Rocky Patches.—Between the Tinker shoal and the east end of the Breakwater are several rocky 4-fathom patches, two of which, near the centre of the eastern channel, are marked by black and white chequered buoys, sometimes termed the fairway buoys. The outer or southern buoy, near which is 26 feet water, lies with the Shagstone on with the peak of the Little Mewstone, S. by E. $\frac{3}{4}$ E., and the Breakwater beacon in line with the citadel flag-staff, N.N.E. The inner buoy has 25 feet near it, and lies with the breakwater beacon on with the citadel flag-staff, N.N.E., and the Breakwater lighthouse on with the gamekeeper's cottage, Mount Edgecumbe, N.W. $\frac{3}{4}$ N.

Mewstone Ledge runs out $1\frac{1}{2}$ cables in a south-westerly direction from the peak of the Little Mewstone, and its extremity is marked by a red buoy moored in $7\frac{1}{4}$ fathoms at low water, with the peaks of the Great and Little Mewstones in line, E.N.E. ; the south-west end of Picklecombe fort, in Mount Edgecumbe park, touching the north side of the Breakwater lighthouse, N. by W. $\frac{3}{4}$ W. ; and the flag-staff on Mount Wise in line with the inner edge of the Shagstone.

The Shagstone on with the Breakwater beacon, bearing North, leads nearly 2 cables westward of the reef.

The Shagstone is a small square-headed rock, about 9 feet above high water, lying one mile N.N.W. $\frac{1}{2}$ W, from peak of Mewstone, and one sixth of a mile from a rocky islet called the Reny, there being between the two a reef of detached rocks dry at low tide. The Shagstone marks the outer edge of a rocky ledge, which fronts the shore between the Mewstone and Bovisand bay, and forms during the day an admirable mark.

To the northward of the Shagstone, as far as Andern point, this ledge extends half a mile off shore, and its outer edge is marked by two red buoys, the southernmost of which is moored in $4\frac{1}{4}$ fathoms with the Shagstone on with the peak of the Mewstone S.S.E. $\frac{1}{2}$ E, and the Breakwater beacon on with east end of Hoe quarry, N. by E. $\frac{1}{4}$ E. The northern buoy is placed in $5\frac{1}{2}$ fathoms, with the chapel on Rame head on with first hollow in cliff north of Penlee point, W. by N. ; and the Breakwater beacon on with boundary wall of West Hoe quarry, N. by E. $\frac{1}{3}$ E.

DANGERS WITHIN THE BREAKWATER.

Within the Breakwater are the Duke rock, and Leek bed on the eastern side of the Sound ; the Queen's grounds and other shoals near Redding point on the western side ; the Bridge, extending from Redding point to Drakes island ; the Dunstone shoal near Dunstone point ; the Melampus,

a ledge extending from the south-east angle of Drakes island ; the Asia, Winter, Mallard, and Cobbler shoals, between Drakes island and Mount Batten ; the flat on north side of Drakes island ; the Vanguard and German rocks on south side of Devils point ; the Cremill shoal, extending from Cremill point ; and the Rubble or Harbour shoal, running off from the south-west angle of the dockyard.

Duke Rock lies near the west end of a bank extending in a convex form between Staddon and Rams cliff points. Near the outer edge of the rock a white buoy is moored in 5 fathoms about one-third of a mile N.N.E. $\frac{1}{2}$ E. from the Breakwater beacon, and nearly the same distance from Bovisand pier head ; it also lies with the eastern high chimney in the Victuallery-yard, on with the west high water extreme of the islet lying off the north end of Drakes island, N. by W. $\frac{1}{4}$ W. ; the obelisk on the Hoe on with Diamond mark, N. by E. $\frac{1}{2}$ E. ; and south end of Bovisand cottages on with tangent of circular fort at Bovisand, S.E.

The least water over the rock, 18 feet, lies half a cable south-eastward of the buoy, and there are 4 and 5 fathoms between the shoalest heads.

Queen's Grounds consist of several patches of rock, with from $3\frac{1}{4}$ to 4 fathoms water, nearly midway between Picklecombe point and the Breakwater lighthouse. A red buoy is placed in 5 fathoms on their south-eastern extremity, with Devils point block-house in line with Redding point, N. by E. $\frac{3}{4}$ E., and the peak of the Mewstone on with the Breakwater west crane, S.S.E. $\frac{1}{3}$ E. On the west side of the Sound the ground is generally hard and rocky, and unfit for anchorage.

New Grounds.—The depth on the shoalest part of this rocky shoal has been reduced by the diving bell to 29 feet on their shoalest part, near which a red buoy is moored, with the east building shed in dockyard just open eastward of trees on Wilderness point ; the engine-house tall chimney in dockyard, just clear of Wilderness high water point, N. $\frac{3}{4}$ W. ; and St. Johns church, Plymouth, on with lower part of retreating angle in citadel wall, just within Fishers Nose, N.E. $\frac{3}{4}$ E.

The Bridge is a rocky reef or submarine causeway connecting Drakes island with Redding point. The deepest channel over it has 7 feet at low water springs, and is indicated by two beacon buoys, the inner one white and the outer one red ; vessels may pass them on either side, but very closely, as the channel is narrow.

During bad weather, especially with a southerly wind and an ebb tide the sea breaks heavily across the whole of this channel, and no boat or small craft should then attempt it after half ebb. The leading mark through is, St. Johns chapel, Devonport, in line with the blockhouse on Devils point, N. $\frac{1}{2}$ W. The cross mark for the shoalest part of the Bridge

in the channel, is the south-eastern extreme of the rampart of Drakes island on with the south-east angle of the citadel.

Dunstone Rock lies West 2 cables from Dunstone point, on the east side of the Sound; and from its shoalest head, with 19 feet water, Charles church, Plymouth, is in line with the west side of Fishers Nose, N. by E. $\frac{1}{4}$ E.; and the obelisk on Mount Edgecumbe is on with the north extreme of the fort on Drakes island, N.W. $\frac{3}{4}$ W. There are 4 fathoms water within and around the rock.

Melampus Shoal is the south-eastern extreme of the rocky ledges extending from Drakes island. It is marked by a black buoy, from which St. Andrews church tower, Plymouth, is touching the west side of the obelisk on the Hoe, N.E. by N. easterly; St. John's chapel turret, on with Victualling yard gate ball; and Bakery chimney (eastern) in Victualling yard, over N.E. cliff of Drakes island.

Asia Shoal, at the north-eastern extremity of the ledges extending from Drakes island, is marked by a white buoy which lies in 21 feet water, with the N.W. and N.E. buoys of the Winter in line with Mount Batten coast-guard flag-staff, E.S.E.; the Camera on the Hoe on with the south-east angle of Esplanade terrace, N.E. $\frac{1}{4}$ N.; and Mount Edgecumbe ruin on with the south-east extreme of the islet off north-west end of Drakes island, W. $\frac{1}{2}$ S.

Winter Shoal, with 10 feet water, lies nearly midway between Drakes island and Fishers Nose. Between it and the island there are not more than $4\frac{1}{2}$ fathoms at low water, but eastward of the shoal there are from 10 to 18 fathoms; it may therefore be considered as a rocky knoll rising from the ledge on which the island stands. Within the 3-fathom line of soundings the shoal is nearly square, and about 120 yards across; it is marked by three buoys, viz., one on its north-west edge, another on its north-east, and the third on its southern edge.

N.W. buoy, striped red and white, lies in 4 fathoms water, with Gills soap factory chimney on with north-east angle of West Hoe terrace, N. $\frac{3}{4}$ W.; Bank's house (yellow) in Queen Anne ship-yard on with east angle of Citadel, E. $\frac{3}{4}$ N.; and Mount Edgecumbe ruin in line with south end of barracks on Drakes island, W. $\frac{1}{4}$ S.

N.E. buoy, chequered red and white, lies in 5 fathoms, with Gills soap factory chimney over the east end of the lime-kilns in West Hoe quarry, N. by W. $\frac{3}{4}$ W.; half of the coast-guard houses at Cawsand seen open of Redding point, W. by S. $\frac{1}{2}$ S.; and the south side of Buenos Ayres trees touching the north side of Batten point coast-guard houses, E. by S. $\frac{3}{4}$ S.

South buoy, red, lies in 3 fathoms, with the north end of Cawsand coast-guard houses touching Redding point, W. by S. $\frac{1}{4}$ S.; the chimney of Gills soap factory just open westward of the lime-kiln, and over the east end of the counting-house of West Hoe quarry; and the

obelisk at Cremill point on with the end of the grass on Bottlenose point, N.W. by W. $\frac{3}{4}$ W.

Mallard Shoal lies south of the citadel, and directly in the fairway to Catwater; the least water over it is 12 feet, and there are 5 and 6 fathoms on all sides. Its north-west extreme is marked by a black buoy, lying in 7 fathoms, with Cawsand coast-guard houses just in sight over Redding point, W. by S. $\frac{1}{2}$ S.; and the obelisk on Mount Edgecumbe in line with second embrasure of Western King fort, W.N.W.

Cobbler Shoal is the west extreme of the rocky ledge extending from Mount Batten, and its outer end is marked by a black buoy moored in $2\frac{1}{2}$ fathoms, with Devonport monument on with south-west extreme of wall, West Hoe terrace point, N.W.; and the southern of two tall chimneys at Catdown, its own breadth open of the quay on Mount Batten point, E. $\frac{1}{4}$ N. At the distance of half a cable north-east of the buoy there are only 6 feet water.

Drakes Island Flat, of sand and mud, extends off fully halfway from the north side of Drakes island to the opposite shore. The north tangent of Wilderness point, on with south tangent of Western King or Bottlenose point, W.N.W., skirts its northern edge in 4 and 5 fathoms at low water. A black buoy marks the north-west spit in 10 fathoms, and from it Cremill obelisk is on with Wilderness point, and the east end of Esplanade terrace, is over the middle of West Hoe terrace.

Vanguard and German Rocks are the highest heads of several rocky patches lying South from Devils point. The German, with only $2\frac{1}{2}$ feet water, lies 146 yards from the blockhouse on the point, and can only be in the way of small vessels. The south extreme of Staddon point on with high water rocks south of Drakes island, S.E., leads outside the German rock, and between it and the Vanguard.

The Vanguard, with 3 fathoms over it, lies fully one-third across the channel, and is much in the way of large ships going to and from Hamoaze; its south side is marked by a black mooring buoy, placed in 5 fathoms. From the shoalest head, of 3 fathoms, Mount Wise flag-staff is in line with the centre of tower on Devils point, N. $\frac{3}{4}$ W.; the Victualling office clock vane is on with west end of Western King fort, N. by E. $\frac{3}{4}$ E.; and the Camera mast on the Hoe is on with south-west angle of West Hoe terrace, E. $\frac{3}{4}$ N.

Cremill Shoal is a spit running off from Cremill point, and its north-east extreme is marked by a black conical buoy. The Breakwater light-house, open of Ravenness point, S. $\frac{3}{4}$ W., until the first building at Southdown opens of Cremill point, bearing West, clears the shoal on its eastern side.

Bubble Bank or Harbour shoal is a ledge of slate rocks running off the south-west point of the dockyard fully half-way across the channel; there

are 3 fathoms over its shoalest head, named the Pollock rock ; the western end of the shoal is marked by a black buoy.

Devonport monument in line with entrance of mast pond, N.E. by E. $\frac{1}{4}$ E., leads eastward of the Rubble ; the flag-staff at N.W. angle of Victualling yard, in line with western or brewery chimney of same yard, leads southward ; and the Dockyard chapel tower open north of master-attendant's office, N.E. by E. $\frac{1}{2}$ E., leads to the northward.

For clearing the extensive mud flats that fringe the rivers which discharge themselves into the Sound, it is better to trust to the knowledge of local pilots and the chart, than to attempt diffuse descriptions.

TIDES.—At Devonport dockyard it is high water, full and change, at 5h. 43m. ; springs rise $15\frac{1}{2}$ feet. neaps $11\frac{1}{2}$ feet. The range of tide is greatly influenced by the wind ; southerly gales raise the water from 2 to 3 feet above its ordinary level, whilst strong northerly winds cause a corresponding depression. At the Breakwater it is high water about a quarter of an hour earlier than at the dockyard.

The tides are tolerably regular in Plymouth Sound, running each way about six hours, and following the trend of the shores ; on an average the turn of the stream takes place half an hour after high and low water on the shore. The greatest velocity at the entrance, and in the Sound, is about $1\frac{1}{2}$ knots ; and in the harbour, $2\frac{1}{2}$ knots.

The flood runs up fair between Asia and Winter shoals, tending rather to set over the former. From Vanguard rock it sets towards Barn pool, and thence turns towards the fair channel and runs for Mount Wise ; after which it takes the fair course of the harbour. When leaving Hamoaze on the flood, take care to guard against the tide which sets strong from Vanguard rock towards Barnpool, for in the attempt to round that rock vessels are often caught by the flood on their port bow, and although they meet it with starboard helm, are frequently set into Barn pool, even into the eddy.

The ebb, from off the dockyard, sets directly from the Rubble bank towards Millbrook lake, so that vessels in going out of Hamoaze on the ebb, must be careful that they are not set over on the flag-ship before they can recover their course. From Mutton cove it runs towards Devils point and sets with great strength over Vanguard rock. The eddies within the Vanguard and off Devils point are very strong.

DIRECTIONS through WESTERN CHANNEL.—One remarkable feature in the soundings on approaching Plymouth Sound is, that a depth of 20 fathoms at low water extends along parallel with the shore, passing three-quarters of a mile outside Rame head, the Mewstone, and Stoke point, and $2\frac{1}{4}$ miles outside the Breakwater, which will materially assist in showing the vessel's position in thick or foggy weather.

There are two entrances into the Sound, one, the Western channel,

between the red buoy of the Queen's grounds and the western end of the Breakwater, and the other, the Eastern channel, between the eastern end of the Breakwater and Staddon point. The former is nearly half a mile wide, and carries from 6 to 9 fathoms at low water; but the 5-fathom channel of the latter is narrowed in some places to the breadth of 80 yards.

The Western channel is the only entrance that can with safety be used by large ships at all times of tide. When bound through it from the westward, after passing Rame head, keep a good quarter of a mile off-shore, and do not attempt to round Penlee point until Mount Batten tower is in line with the Breakwater lighthouse, N.E. by E. $\frac{1}{4}$ E.; this mark will clear the Draystone, and lead up towards the western end of the Breakwater, to which give a berth of a cable's length in rounding, and then haul to the north-east for the anchorage.

In working through the Western channel, when standing towards the Draystone, do not open Mount Batten tower westward of the Breakwater lighthouse. When the vessel is northward of the line of Stoke point on with north high water point of Mewstone, S.E. $\frac{1}{4}$ E., in standing towards the Knap and Panther, do not open the tower to the eastward of the lighthouse. When standing towards Queen's grounds avoid shutting in the east end of Esplanade terrace with the east end of Drakes island; and in working along the south side of Drakes island, keep the whole of Cawsand open of Redding point.

Cawsand bay may be ranged by the lead alone; in working through, however, if the ship is of large draught, do not approach within a quarter of a mile of its southern shore, nor stand farther westward than to bring the west end of Drakes island touching Redding point. Having passed the line of the Breakwater, or the lighthouse and beacon in one, keep a good half mile off shore.

Vessels from the eastward intending to enter the Sound by the western channel, and being about half a mile outside the Little Mewstone, with the Breakwater beacon and Shagstone in line—which is the clearing mark for Mewstone ledge—should steer so as to pass outside Knap shoal, the fore clearing mark for which is Maker church in line with Gamekeeper's cottage N. $\frac{1}{2}$ W.; and the back mark, the north high water line of Great Mewstone in line with Stoke point S.E. $\frac{1}{4}$ E. After passing the Knap proceed as above directed.

At Night bring the Eddystone light to bear S.W. $\frac{1}{4}$ W., and keeping it in that direction astern, run boldly in until the *red* light in the Breakwater lighthouse is seen, which will be right ahead if the bearing of the Eddystone has been preserved. Having made the red light, steer for it on a N.E. by E. $\frac{1}{2}$ E. bearing until the *white leading* light in the lighthouse is seen, when the channel will be open, and keeping the white

leading light in sight, run direct for it. After rounding the breakwater, haul to the north-eastward, but do not anchor till the *red* light has fully changed to *white*, which it will do when it bears S.W. $\frac{1}{2}$ W.

Through EASTERN CHANNEL.—The Eastern channel into the Sound should not be attempted at night, nor at any time by vessels of large draught, unless with a free wind, or with steam, because of the numerous rocks which are scattered in its vicinity, and the occasional scend or depression of the sea there with south-westerly and south-easterly winds. The channel is marked by buoys, the passage between which, as already remarked, is in some places very narrow, but free from danger.

The obelisk (painted with white and red horizontal bands) on the Hoe, kept exactly in line with the Breakwater beacon, N. by E. $\frac{3}{4}$ E., leads through between the Tinker and Shagstone, and between the shoals on either hand direct to the east end of the breakwater, in not less than 5 fathoms at low water. After rounding the breakwater at the distance of a cable from the beacon, steer to the north-west for the anchorage, taking care to avoid the Duke rock.

There is a channel frequently used by vessels between the east end of the Breakwater, and the shoal patches of the Eastern channel. It is about three-quarters of a cable wide, and not less than 5 fathoms will be found in it at low water, with the flag-staff on the eastern part of Bovisand pier ranged from edge to edge of the north tower of Staddon fort. To sail through, keep the flag-staff in line with the centre of the north tower, E. by N. $\frac{1}{4}$ N. This channel is also useful to vessels bound westward with scant westerly winds, when, owing sometimes to the crowded state of the Sound, they have not room to make their boards to the westward.

Small vessels well acquainted with the place generally run through the Eastern channel at night by keeping Sutton pool pier light just open of Batten point; but no stranger should attempt it, as the light is not easily distinguished from those of the town.

When running into or out of the Sound in the daytime upon any of the before-mentioned leading marks, bear in mind that so long as Bolt head is in sight south of the Mewstone, the vessel will be without or southward of all the shoals; and that Bolt head shut in with the Mewstone, ranges closely upon the tails of both the Tinker and Knap. When entering the Sound from the eastward, do not approach the Mewstone nearer than half a mile, till the Breakwater beacon is in one with the Shagstone bearing about North, which mark will lead 2 cables westward of the Mewstone reef in 11 fathoms water.

DIRECTIONS for HAMOAZE.—Two channels lead into Hamoaze, one carrying 12 to 15 fathoms between the Winter and Mallard shoals, the

other 4 fathoms between the Winter and Asia. Gills soap factory chimney ranged from end to end of West Hoe terrace marks the limits of the channel between the Winter and Asia, and this passage is generally taken by large vessels, except at dead low water springs ; for although the other is deeper the turning is sharp, and there is a difficulty in winding a long ship.

The wind from S. by W., round by south, to East, will enable a vessel to lie through either channel into Hamoaze ; and from West, round by north, to N. by E. will allow her to proceed from Hamoaze to the Sound without a tack ; but it must be remembered that near half flood the stream runs with great strength, particularly between Cremill point and Devils point, so that even in a steam-vessel great caution is necessary, and it is therefore not desirable to move a ship during the strength of the tide.

When proceeding through either of the above channels from the anchorage in the Sound, steer to the north-eastward to bring the obelisk on the Hoe in line with the diamond mark on a high water rock below the Hoe, bearing N. by E. $\frac{1}{2}$ E. ; this will lead between the Winter and Mallard shoals : or, if intending to take the channel between the Winter and Asia shoals, the leading mark through is Gill's soap factory chimney on with centre of West Hoe terrace N. $\frac{1}{2}$ W.

Keep either of these marks on until Cremill obelisk is on with the second embrasure in Western King fort, W.N.W., which will lead through the fair-way north of Drakes island ; until the south-east angle of Esplanade terrace, on the Hoe, is in line with the south-west angle of West Hoe terrace, below the Hoe, E. by N. $\frac{1}{4}$ N. Then haul to the south-west, and proceed with these latter marks on between Drakes island and the Vanguard rock, until the east extreme of Cremill quay is nearly on with Wilderness point, N.N.W. $\frac{1}{2}$ W., or Mount Wise comes well open of Devils point about N. $\frac{1}{2}$ W. ; then haul a port to bring the cupola of St. Johns chapel, Devonport, in line with the flagstaff on Mount Wise bearing North, which will lead in mid-channel between Devils and Wilderness points.

The pilots, however, after rounding Vanguard rock, usually keep over towards Mount Edgecumbe battery, to avoid the strong eddy on the flood caused by Devils point and the foul ground off it ; bearing in mind that to clear Cremill shoal, the Breakwater lighthouse must be kept open of Ravenness point, S. $\frac{3}{4}$ W.

When the first building at Southdown comes open of Cremill point, bearing West, the vessel will be northward of the Cremill shoal, and may run up the harbour, taking care on nearing the Rubble to keep the south extreme of Drakes island touching Cremill point, S.E. by S., or the flag-

staff at N.W. angle of Victualling yard, on with western or brewery chimney of same yard, S.E. by E. $\frac{1}{4}$ E. ; either of these marks will lead south of the Rubble, and when the tower of the Dockyard chapel opens north of the master-attendant's office, N.E. by E. $\frac{1}{4}$ E., either anchor or proceed farther up the harbour.

. There are also two 4-fathom channels, one between the Mallard and Cobbler shoals, by keeping the spire of St. John's church, Plymouth, in line with Fisher's Nose, N.E. $\frac{1}{2}$ E. ; and the other between Mallard shoal and the Citadel, by keeping Raveness ruin on Mount Edgcombe between the two barracks on west end of Drake's island, W. $\frac{1}{2}$ S. This latter mark leads up to the following mark for the best water to Turnchapel docks, viz., St. Andrew's church tower, in line with the lamp on west pier head of Sutton pool, N.N.W. $\frac{1}{2}$ W.

The RIVER TAMAR rises near Moorwinstow, in the moors which form the north-east point of Cornwall, and after following a southerly course for about 60 miles, and forming the boundary between Devonshire and Cornwall, falls into the sea in Plymouth Sound. It has some small tributaries called the Deer, the Claw, the Werington, the Attery, the Lyd, and the Inny.

Below its junction with the Inny, its course, hitherto tolerably straight, becomes more sinuous, especially when it skirts the base of Hingston down, after which the river gradually widens out. Near its mouth, on the left bank, it receives the waters of the Tavy from Dartmoor forest, and on the right bank the Lyhner or St. German river from the downs between Launceston and Bodmin.

The river is tidal for the distance of 16 miles from its mouth to the Weir Head, the entrance to the canal a quarter of a mile below which may be reached at high water ordinary springs by vessels of 5 feet draught. This Head or barrier is a solid wall of large blocks of stone held together by iron clamps, 15 feet wide on the top and 100 feet in length, and is partly dry when the river is in a very low state. It was built about 100 years ago for the purpose of establishing a salmon fishery and to keep up a head of water for the use of the adjoining canal, by which there is barge communication with the reach above, that fronts the large and increasing village of Gunnislake.

On the right bank, at 4 miles below the Weir, is the village of Calstock, containing in 1861 a population of 1,400, chiefly employed at the mines and in the despatch of vessels. Here the river is navigable for vessels of 12 feet draught at high water, and for boats only at low water springs. In the year 1861, 70,000 tons of shipping (chiefly schooners of 120 tons burthen) passed this place laden with coals and copper ore. Opposite the village is a convenient building yard, where barges and vessels of upwards

of 100 tons burthen are well built and repaired. The river has 10 feet only in it during low water at its junction with the Tavy, which is tidal for 5 miles, or up to the falls, which may be reached at high water springs by vessels drawing 5 feet. At Maristow quay, and a half mile lower down, vessels of 8 and 10 feet draught unload.

The town of Saltash stands on the ascent of a steep hill on the right bank of the Tamar, a little above its junction with the St. German. In 1861 its population, which are chiefly fishermen and those connected with the navy, amounted to 1,900. Here the river is crossed by the Royal Albert bridge, over which passes the Cornwall railway. This noble structure consists of 19 spans, 17 of which are small and lead from the hills on either side, but the two others, resting on a cast-iron pier of four columns in the centre of the river, cross the whole stream, a distance of 910 feet. Its greatest length is 2,240 feet, its width at basement 30 feet, and the height of centre pier from foundation to summit 260 feet. The roadway is 100 feet above high water springs, at which time of tide there are $11\frac{1}{2}$ fathoms in the channel on the west side of the centre pier, and $9\frac{1}{2}$ fathoms in that on the east side. Saltash is also connected with the opposite shore by a steam bridge.

The tide flows up the St. German as far as Tideford, which is $6\frac{3}{4}$ miles from its junction with the Tamar, and may be reached at high water by vessels drawing 6 feet.

The town of Torpoint is 2 miles below Saltash, on the right bank of the river opposite Devonport, with which it is connected by a steam bridge. In 1861 its population was rather more than 2,000, the majority of whom belong to the navy and the naval establishments of Devonport.

TIDES.—It is high water, full and change, at Saltash in the river Tamar at 5h. 45m., springs rise 15 feet, neaps 11 feet; at Cargreen, at 5h. 47m., springs rise $14\frac{3}{4}$, neaps $10\frac{3}{4}$ feet; at Pentillie at 5h. 55m., springs rise $13\frac{1}{2}$, neaps $9\frac{1}{2}$ feet; at Calstock at 6h. 6m., springs rise $12\frac{1}{2}$, neaps $8\frac{1}{2}$ feet; at Morwellham at 6h. 12m., springs rise $10\frac{1}{2}$, neaps $6\frac{1}{2}$ feet; and at the Weir Head at 6h. 17m., springs rise $5\frac{1}{4}$, and neaps $1\frac{1}{4}$ feet. At Warleigh quay in the river Tavy at 5h. 47m., springs rise $14\frac{1}{2}$, neaps $10\frac{1}{2}$ feet; at Maristow at 5h. 47m., springs rise $8\frac{1}{2}$, neaps $4\frac{1}{2}$ feet.

WEMBURY BAY.—The coast from abreast the Mewstone trends to the south-east $1\frac{1}{2}$ miles to Yealm head, forming a bight named Wembury bay, which receives the waters of the Yealm in its north-east corner. The outer or south point of Yealm head is low at its extreme, and may be known by having the measured mile beacon, painted white, on its western face.

The bay has irregular depths in it, 4 to 8 fathoms, rock, sand, and gravel, with rocky patches of $2\frac{3}{4}$ fathoms near the shore. Two detached reefs a

cable apart and partly dry at low water, named the Slimers, lie on the western shore of the bay, $1\frac{3}{4}$ cables off the east side of the Mewstone; and on the eastern shore are two patches, called the Ebb rocks, on the western of which, lying W. by N. $\frac{1}{4}$ N. distant 3 cables from the south point of Yealm head, is a rock nearly awash at the lowest tides, that has occasioned the loss of several vessels and many lives.

This bay is three-quarters of a mile deep and the same in width at entrance between the Slimers and Ebb rocks, but it can only be considered as a roadstead for vessels bound into the Yealm. Near the entrance of the latter are two tidal ledges that materially reduce the space of navigable water in the bay; viz., Church ledge, which projects 2 cables from the shore in a S.W. $\frac{1}{2}$ S. direction from Wembury church, and Mouthstone ledge, one cable N.W. by W. from the inner point of Yealm head.

The Breakwater lighthouse on with Maker church, N.N.W. $\frac{2}{3}$ W., leads 2 cables south-west of the Ebb rocks; and Wembury church (square tower) its own length inside the west entrance of Langdon trees, N.N.E. $\frac{1}{3}$ E., leads about a quarter of a cable from their western side. The western hedge of a narrow field on with the eastern edge of a woody patch in a valley behind, N.E. $\frac{1}{2}$ N., leads eastward of the Slimers; and New Barton farm (a solitary house near the north entrance point of the Yealm) in line with the south-east angle of a hedge inland, E. $\frac{1}{2}$ N., or Rame church open south of the Little Mewstone, leads to the southward.

THE RIVER YEALM has its entrance in the north-east corner of Wembury bay, $2\frac{1}{2}$ miles E. by S. from the peak of the Mewstone. It is easy to be made out from being at the commencement of a long easterly range of cliffy shore, and from the dark zig-zag line marking its course through the coast ranges of 300 feet in height. The entrance between Season point on the north and the inner point of Yealm head on the south, is $1\frac{3}{4}$ cables wide, and inside this line vessels drawing 12 feet and waiting tide should not proceed. Season point is a steep cliffy head, with a black rock at its south-west face.

From the entrance the general direction of the river is E. by S. $\frac{1}{2}$ S. three-quarters of a mile to Warren point, the average width at low water one cable, and depth 9 feet; thence to Stert point the direction is N.E. $\frac{1}{2}$ N. $1\frac{1}{4}$ miles, the average width three-quarters of a cable, and the depth 10 feet. At Stert point, which is singularly woody and low, the river ceases to be navigable at low water even for boats, and it here divides into two arms, the Cofflet and the Yealmpton. The Cofflet arm takes a northerly direction for one mile, with a high water width of half a cable and a depth of 10 feet.

The direction of the Yealmpton arm is E. by N. $1\frac{1}{4}$ miles, when it suddenly narrows to a breadth of 50 feet, and is nearly fresh at half-tide;

this width it preserves, winding its way through a rich woodland vale, in most inviting pools and rapids, past the village of Yealmpton distant nearly a mile. Although this arm, like the Cofflet, is at low water threaded only by a small stream that would not float a boat, half way up it has a high water width of nearly half a mile and a depth of 10 feet, and is here joined on the northern shore by another small arm which terminates in the ornamental waters of Kitley. Limestone and coal barges of 4 and 5 feet draught often discharge their cargoes at Kitley quay.

Opposite Warren point there is another branch a mile in length in an E. by S. $\frac{1}{4}$ S. direction, called the Newton Ferrers arm, which has a width of half a cable and a depth of 10 feet at high water, but at low tide there is not sufficient water for a boat. Midway on its north shore is the village of Newton Ferrers, and on the opposite shore the village of Noss; the latter skirts the steep sides of a small creek, where vessels of 100 tons burthen occasionally discharge.

The shores of this branch are formed of steep grassy slopes, here and there dotted with irregular patches of wood, which in places overhang and touch the water, rendering it difficult on still calm occasions, to discern where the true and reflected pictures meet. Such is also the general character of the banks of the Yealm, and when there is much wind, the overlooking or walling-in heights cause sudden gusts, which make boat sailing dangerous and the handling of sailing vessels uncertain.

DIRECTIONS.—The dangers to guard against in approaching the entrance of the Yealm, are the Slimers reefs on the western shore of Wembury bay; the Church ledge extending from the northern shore under Wembury church; the Ebb rocks off the outer point; and the Mouthstone ledge off the inner point of Yealm head on the eastern shore. Vessels should not attempt to enter during strong south-west winds, when frequently a line of breakers extends across from the Slimers to the Ebb rocks, and others on the irregular ground inside them.

Wembury church bearing N.E. will lead into the bay clear of all danger, until a small hummock on the high extreme of Warren point bears E. by S., and is over the extreme of Misery point. This latter mark will lead into the entrance of the river, passing one-third of a cable northward of the Mouthstone ledge; the latter may also be cleared by keeping a clump of large trees in the valley over Cellar bay in sight or open of Yealm head.

Between Season and Misery points, and projecting from the northern shore, is an extensive sand-bank of 2 and 3 feet water, between which and the southern and eastern shore of Cellar bay is the channel of the river, only 40 yards wide, and 6 and 8 feet in depth at low water after passing the bay, the deep-water line to which lies along the southern shore. The coastguard look-out hut on Warren point kept open of Misery point leads

through this channel, which ends at the latter point, off which a shoal of 3 and 4 feet water extends 70 yards.

At Misery point the channel deepens to 12 feet, and is on the north shore ; thence to the best anchorage the deepest water is 10 and 12 feet. The part of the river most frequented for this purpose is the centre of the stream between the Ferry house and the outer point of the Newton Ferrers arm, the depth at low water being from 9 to 12 feet. The flat off Warren point which fronts the anchorage should be guarded against.

TIDES.—In the mouth of the Yealm it is high water, full and change, at 5h. 37m.; springs rise $16\frac{1}{4}$ feet, and neaps $11\frac{1}{2}$ feet. During the freshes which occur between the months of October and February, the stream of the river abreast Warren point occasionally runs down at the rate of 4 knots ; at other times its greatest velocity is $1\frac{1}{4}$ knots for the flood, and $2\frac{1}{4}$ knots for the ebb.

Stoke Point Rock.—About $1\frac{1}{4}$ miles south-east of Yealm head is Stoke point, which is a low peak with a light coloured base ; a third of a mile eastward of the point are two conical stone beacons 6 feet high for pointing out the position of Stoke point rock, which lies S. by E. half a mile from the extreme of Stoke point, and $3\frac{1}{2}$ cables from the nearest shore, with only 8 feet water on it ; but with 11 fathoms close to its south side, and 8 to 4 fathoms between it and the land. The two stone conical beacons on the shore abreast it when in one, bearing N.E. by N., point to the rock ; by keeping them open a vessel will pass clear of it on either side ; the town of Cawsand open south of the Mewstone, N.W. by N., leads outside it.

BIGBURY BAY is an extensive bight between Stoke point and Bolt tail, and although open to the full force of S.W. gales, is less formidable than is generally believed. Its appearance from a distance is very uninviting for a vessel to close with ; but, although the coast is rugged and fronted at low water by extensive rocky ledges and numerous scattered rocks, there are no dangers outside half a mile from the shore.

Generally speaking, there is an absence of any remarkable feature in the coast between Yealm head and Bolt tail, and from a distance it assumes the appearance of a line of even topped heights, backed by the craggy tors and wild mountain features of the Dartmouth hills. Indeed, were it not for such objects as the Mewstone with its light stripe, the high yellow patch on Yealm head, the high grey cliffs between the Erme and Avon, with Borough island, it would be difficult to recognize from a distant offing any part of this coast. On a nearer approach, the square church towers of Thurlestone and Churchstowe, as well as the sharp spires of those of Bigbury and Marlborough, will serve to identify the land in their immediate neighbourhood.

The shores of Bigbury bay may be closely approached by vessels keeping near the land for smooth water, or to avoid the offing tide ; and they may also do so in thick weather, or during the night, by paying strict attention to the lead. The shoalest water is in the eastern part of the bay, and then, under such circumstances, a depth of less than 6 or 7 fathoms at low tide should be avoided ; 13 and 14 fathoms will be found at 2 miles off shore.

In the western part of the bay the water is deeper, there being 19 fathoms about three-quarters of a mile from the shore in the neighbourhood of Stoke point, farther westward the shore should not be approached within the depth of 10 fathoms. Off Plymouth Sound, if the water shoals from 20 to 15 fathoms, the Breakwater will be distant 2 miles, and the vessel just within the 20-fathom edge of soundings.

RIVER ERME.—The mouth of this river is readily recognized by the remarkable wooded clumps over the white coast-guard buildings just within the island-shaped western entrance point, and by the solitary pilot's house inside Muckstone point on the eastern side. The river having a straight sea reach for 6 cables in a N.E. direction from the bar, with a high water width of 2 cables, appears of some importance from the offing; the bar, however, dries at low water, and it is only navigable for the above distance for vessels of 9 or 10 feet draught when the water is smooth. Coal barges thread their way up $2\frac{1}{2}$ miles from the entrance, where the stream is only 20 yards wide, a width it preserves nearly to the foot of the Dartmoor hills.

This river cannot be entered when there is any swell to make broken water on the bar. The approach is by no means clear, for at 4 cables outside the bar are the Merry reefs, which dry at low water nearly across the entrance from the eastern shore ; and 2 cables outside them, and three-quarters of a mile from Muckstone point, is Edwards rock, with only 5 feet water, from which the white stone beacon, close to the northward of the pilot's house, is in line with the west extreme of the point bearing E. by N. $\frac{1}{2}$ N.

The pilot's house kept its own breadth open of the head, and in line with Kingston four firs (a small solitary group on a high back ridge) is a safe lead towards the bar, passing westward of Edwards rock, and between the Merry reefs and Roadstead point.

Wells Rock, with only 5 feet water, is the most outlying danger on this part of the coast. It lies half a mile from the shore, between the mouths of the Erme and Avon, and from it Ringmore church appears over the west corner of a small sandy beach, E. $\frac{1}{4}$ S., and the summit of Borough island bears S.E. $1\frac{1}{2}$ miles.

RIVER AVON.—Between the rivers Erme and Avon, a distance of 3 miles in a south-easterly direction, the coast is composed of whitish cliffs, from 200 to 300 feet high, having their base fronted with projecting ledges and numerous scattered rocks. Near the Avon the cliffs become lower, and are separated by small bays, with sand and shingle beaches; in Challabro cove, the first of these bays westward of the Avon, there is a coast-guard station, and limestone vessels discharge there in very fine weather. Across the entrance of the river, which is only navigable for vessels of 9 or 10 feet draught, is a bar which dries, so that it cannot be entered when there is any swell. From the high, dark, cliffy eastern head, a sandy tongue of land and spit extends well over towards a bend in the shore close within the western head. This low tongue makes a sudden and awkward turn in the direction of the channel, and causes a great rush of tide by contracting the width of the stream.

The Avon equals in beauty any of the South Devon rivers, particularly above Aveton Giffard, 4 miles within the entrance, where it runs between wooded shores till its character changes to a mere wild moor-side brook. In the lower and navigable parts below Aveton Giffard, at certain times of tide, it has the appearance of a noble sheet of water, with open woodland shores, broken here and there by a bay or creek. Coal barges and cargo boats discharge at Aveton Giffard, but the limestone and coal vessels which carry all the import trade, seldom go above the village of Bantham, a mile within the entrance. These vessels often lose weeks waiting for a favourable bar and wind to get out.

Borough Island, which is connected at low water by a sandy neck to the western entrance point of the Avon, is a high rounded lump, resembling Looe island. A rocky ledge, which dries at low water, extends 2 cables in an easterly direction from its eastern point, and nearly a cable from the ledge, or 3 cables from the point, is a dangerous sunken rock, known as the Blind Mare.

TIDES.—It is high water, full and change, in the mouth of the Erme, at 5h. 40m., and in that of the Avon at 5h. 47m. The entrance to both these rivers becomes dry long before it is low water outside, and the tides within their bars rise 5 and 6 feet less than they do outside, which is 16 feet. Where the rivers cease to be navigable, the springs rise 7 feet.

At 4 miles from the shore, between Rame head and Bolt tail, the western stream begins at 8h. 40m., full and change, or 3h. after high water on the shore; and the eastern stream at 2h. 40m., or 3h. after low water. The velocity of each stream does not exceed $1\frac{1}{2}$ knots, but they occasionally sweep past projecting points of the coast at the rate of 2 knots.

HORSEWELL BAY.—Between the Avon and Bolt tail, $2\frac{1}{2}$ miles to the southward, the coast recedes, forming a bight, the cliffs of which lower to the eastward and become broken into heads, which are fronted with extensive rocky ledges. In the depth of this bight, and $1\frac{1}{2}$ miles from the Avon's mouth, is Horsewell bay, which has a long sandy beach, and is remarkable for its low shore, as well as having near its south corner a curious perforated rock, called the Thurlestone, resembling from the offing the hull of a stranded ship.

The Thurlestone is connected with the shore at low water by a rocky ledge, and between it and Ilbert head, the north point of the bay, is a reef, named the Books, which dries at low water, and has proved fatal to many a fishing boat. Between this reef and the ledge extending from Ilbert head is the only clear entrance into the bay, not more than $1\frac{1}{2}$ cables wide, with $2\frac{1}{2}$ fathoms in it at low water. There are 3 fathoms in the middle of the bay, and limestone vessels discharge in its south corner when the water is smooth. Near the centre of the bay, on the northern side of the reef surrounding the Thurlestone, there is good boat landing at low water.

The coast from Horsewell bay to Bolt tail is high, precipitous, and rocky, particularly near and in Hope cove, which is a quarter of a mile only within the Bolt tail, and as an anchorage is only safe with offshore winds. The holding ground is not good, though it is frequently used as a stopping place. The coast-guard flagstaff on a dark rocky head, and a near hill-side chapel, are objects by which this cove may be easily known.

Hamstone and Gregory Rocks.—The Hamstone is a rugged black rock, 10 feet above high water, lying a quarter of a mile off shore, nearly midway between Bolt tail and Bolt head, and a little eastward of the beach of Mill bay cove, the only beach near. There are a few sunken rocks near it.

At half a mile eastward of the Hamstone, and the same distance off shore, are sunken rocks, named Inner Gregory and Outer Gregory, having only 9 feet water on their shoalest head. The first hummock (ruin of a signal house) on Praul point, open south of the Little Mewstone, off Bolt head, S.E. by E. $\frac{3}{4}$ E., leads to the southward of them. Vessels sailing along the part of the coast, between Bolt head and the Hamstone, should keep outside this mark, as there are several dangerous rocky heads in this space.

BOLT HEAD, 416 feet high, is $3\frac{3}{4}$ miles S. E. $\frac{3}{4}$ S. from Bolt tail, and between them a succession of dark rugged-looking cliffs rise abruptly to the height of 400 feet; thence to the eastward land of the same height, with few trees, and intersected by deep ravines, falls back into Salcombe bay, but it rises less abruptly from the shore than it does westward of the

head. Excepting in the neighbourhood of the Hamstone and Gregory rocks, the ground is clear between Bolt tail and Bolt head, and the shore may be approached to a quarter of a mile, but there is no anchoring ground.

SALCOMBE HARBOUR.—The entrance to this small, well sheltered, bar harbour, between Bolt head and Prawl point, may be recognized by the sudden turn to the northward of the cliffs at Bolt head, at the base of which are two conical high water rocks, named Great and Little Mewstone. Vessels of 20 feet draught can cross the bar when the sea is smooth at high water springs, and 16 feet at high water neaps. Salcombe is a small thriving town, and in 1861 its population was 1,600. There are three building yards; and one at Kingsbridge, a small country town at the head of Salcombe river.*

The Range is the name given to an anchorage at the entrance of Salcombe harbour, but it is open to the southward. The best position is with Woodville house on with Lambury point N.N.E., in 6 or 7 fathoms, sand and shell. Should it come on to blow from the southward, weigh immediately, as a heavy sea is then thrown in, when it would be difficult to work out, and unsafe to cross the bar.

Rickham Rock is of small extent, with only 11 feet water; it lies a quarter of a mile off the eastern shore of the Range. Sandhill cottage open of Lambury point, and on with the bend of the road on west side of Salcombe hill, N. $\frac{1}{2}$ W., clears the rock on its western side.

The Bar across the entrance of Salcombe harbour is a ridge of sand extending from a quarter of a mile above the Great Eelstone, a high overhanging rock on the western shore, to Lambury point on the eastern; and at low water springs there is said to be as little as 2 or 3 feet. A heavy sea breaks over it in southerly gales, when allowance must be made for the scend of the sea in crossing. The lead will be the best guide, for, having passed the bar, the water will deepen immediately on either side.

Wolf Rock is of small extent, lying on the eastern side of the channel, within the bar. It dries at low water springs, and from it the summer-house on Pilworthy point is on with Portlemouth ferry house, N.E. by E. $\frac{3}{4}$ E.; and the cottage on south side of Southsand bay is just showing open of the south point of the bay, W. by N. Old Harry beacon open eastward of Charles fort (ruin) leads westward of the rock.

The Poundstone is a large mass of rocks on the west side of the channel, and the centre of their highest part, which covers at 12 feet rise, is marked by a white beacon with ball. At the beacon Woodville house is on with the east side of Charles fort, from which it is distant 180 yards.

* See Admiralty Plan of Salcombe Harbour, No. 28; scale, $m = 7$ inches.

Old Harry, the southern extreme of the rocks extending from Sandhill point, is marked by a white beacon with ball ; the rock covers at 6 feet rise. Charles fort stands on the inner part of these rocks.

The Blackstone is a large rock lying on east side of channel, and just covers at high water springs ; its western end is marked by a red beacon with ball. The channel between Old Harry and the Blackstone is 120 yards across.

TIDES.—At Salcombe it is high water, full and change, at 5h. 41m. ; springs rise 15 feet and neaps $11\frac{1}{2}$ feet. The stream turns at high and low water by the shore, and sets fairly in and out of the harbour ; its greatest velocity at springs being $2\frac{1}{2}$ knots.

DIRECTIONS.—Pilots are generally in attendance at the entrance of Salcombe, and should be employed by strangers. To cross the bar in the deepest water, keep well over on the western shore and steer in with Molt point, on with a clump of trees in Northsand bay, and also on with the bend of the turnpike road on the west side of Salcombe hill, bearing N. by E. $\frac{1}{4}$ E. Immediately the bar is crossed, bring a small thatched summer-house, in trees, on Sandhill point, on with the west side of Charles fort, N.E. by N. ; this will lead nearly up to Poundstone rock, and the vessel will then be near the beacons. Leave the red beacon on the starboard and the white beacons on the port hand going in, and keeping in mid-channel, proceed up to the anchorage off the town.

Should the beacons be washed away, keep the last mark on until the whole of Southsand bay is open, then bring the thatched summer-house on with the east side of Charles fort, and keep it so until Portlemouth Ferry house is on with the west tangent of Scoble copse, E. by N. $\frac{3}{4}$ N. ; this will lead in the best channel nearly up to Woodville house, after which keep in mid-channel to the anchorage.

There is a channel with not less than 4 feet at low water springs, to the eastward of the Wolf and Blackstone rocks ; but it is narrow and winding, and should not be attempted by strangers.

CHAPTER IV.

START POINT TO THE NEEDLES.

VARIATION IN 1869.					
	Dartmouth	-	-	-	21° 40' W.
Torbay	-	-	21° 50' W.	Portland Road	- - 21° 15' W.
Exmouth	-	-	21° 45' W.	Poole Harbour	- - 21° 0' W.

START POINT may be recognized by its rugged, cock's-comb-like appearance, and by the white granite lighthouse, 92 feet high, standing 140 yards inside of its eastern extreme. The five hillocks on the ridge within the lighthouse are each about 200 feet above high water; Peartree head, at three-quarters of a mile westward of the point, is 386 feet above that level.*

The only dangers in the vicinity of Start point to the south and south-west are, the Peartree, the Start, and Cherrick rocks; the two former are close to the shore; the latter lies S. $\frac{3}{4}$ W. upwards of 2 cables from the point, and is awash at low water springs. A sunken rock, with only 12 feet over it, lies at the same distance S.E. $\frac{1}{2}$ S. from the lighthouse, and to avoid it a vessel should not shut in the village of Haulsands with Start point, until Peartree rocks open out south of the Start rocks, when, by giving the latter a berth of about 2 cables, she may proceed to the westward.

LIGHT.—The lighthouse on the Start exhibits, at an elevation of 204 feet above high water, a *revolving* white light of the first order, which attains its greatest brilliancy every *minute*, and in clear weather should be visible from a distance of 20 miles; within the distance of 10 miles a faint continuous light is seen from the lantern. The light is screened towards the land, and is visible from seaward when bearing from S.W. $\frac{1}{2}$ W., round by the west and north, to East.

A *fixed* white light is shown from the same tower, at 12 feet below the flashing light, to guide vessels to Dartmouth and Berry head. It is seen only when Start point bears from W. $\frac{1}{4}$ S. to S.W. by S. By keeping on

* See Admiralty Chart, England, South Coast, Sheet 3, No. 2,620; scale, $m = 0.5$ inch.

its western limit, it will lead between the Skerries and the land ; its other limit passes over the south end of the Skerries. During foggy weather a bell is sounded.

Skerries Bank.—Nearly a mile E. $\frac{1}{4}$ S. from the Start lighthouse is the south extreme of the Skerries, a dangerous bank of pulverised shell and fine gravel, which extends N.E. by E. $\frac{3}{4}$ E. $3\frac{1}{2}$ miles, with an average breadth of half a mile. Near its south end there are only 9 feet water, on the other parts from 2 to 4 fathoms, with occasionally deeper casts. The shoal terminates to the north-east in a sand-bank, nearly a mile in length, with 3 fathoms on its shoalest part. In boisterous weather the sea breaks heavily on all parts of the Skerries, but particularly upon the south-west end ; there is no shelter between it and the land in strong easterly winds, as the broken water reaches to the shore.

DIRECTIONS.—Berry head open of Downend point, bearing N.E., leads eastward of the Skerries ; Street church on with the highest part of Street-head cliff, and a little open of the north end of Slapton beach, N.N.W. $\frac{1}{4}$ W., leads northward ; the Mewstone peak just open of the high land of Downend point, N.E. by E. $\frac{1}{4}$ E., leads between the Skerries and the land ; the west end of the trees over Widdecomb house in line with the northern white house in Beesands, N. by W. $\frac{1}{4}$ W., leads between Start point and its south-west end ; and Praul point open of Start point W. $\frac{1}{2}$ N., clears its south end.

To avoid this bank at night, do not stand towards it into less than 20 fathoms at low water. To pass between the bank and the land, keep the fixed light on Start point S.W. $\frac{1}{2}$ S., and pass the point at the distance of a quarter of a mile on its northern side, and half a mile on the southern. When the Start light bears N.W. by W. $\frac{1}{2}$ W., the vessel will be southward of the Skerries.

From Start point to Portland the course is E. $\frac{1}{4}$ S., and the distance 48 miles ; and from the Start to St. Catherine point about E. $\frac{3}{4}$ S., 93 miles. By altering the courses successively between the meridians of the different headlands, as the vessel advances up Channel, she will better counteract the direct effects of the tidal streams.

Between the Start and Portland, in thick weather, do not approach the shore within the depth of 30 fathoms until the meridian of Portland is passed ; between Portland Bill and St. Catherine point, do not stand into less water than 25 fathoms. The former precaution will keep the vessel southward of the Shambles and Portland Race, as well as in the fair stream of tide ; and the latter will prevent her from experiencing the indraught caused by the flood running into Christchurch bay, and towards the Needles, and Freshwater bay, the duration of which is considerably prolonged by southerly and south-westerly winds.

The soundings, however, to the south-westward, southward, and south-eastward of the Casquets, within the supposed radius of 9 miles, do not materially differ from those in similar directions from Portland, so that it is possible in bad weather for the former to be mistaken by a stranger for those of the latter, particularly if hazy weather prevent the three *revolving* lights of the Casquets from being distinguished, unless indeed soundings were accidentally struck on a bank which lies S.S.W. from the Casquets. For it should be borne in mind that the north-western of these lights bears N.W. $\frac{3}{4}$ W. from the south-eastern light, the north-eastern E. $\frac{3}{4}$ N. from the north-western, and the south-eastern S.W. $\frac{1}{2}$ W. from the north-eastern; and thus the three lights will appear as two only when viewed from either of those three positions, or their opposite bearings.*

As the distance between the Lizard and Portland differs only 5 or 6 miles from that between the Lizard and the Casquets, and as this is the narrowest part of the Channel westward of Beachy head, it is necessary to exercise great caution; for should a stranger be in this supposed southerly position during a winter's night, between the periods of low water and three-quarters flood on the shore, when the indraught is strong into the Gulf of St. Malo, and with a gale between N.W. and S.W., the consequences may be most disastrous. This is a strong additional argument for a constant progressive attention to the lead from the instant of first striking soundings, by which such a perilous situation would be avoided. The Casquets bear from Start point S.E. $\frac{3}{4}$ S., distant 57 miles, and from the Bill of Portland S. by W. $\frac{3}{4}$ W. 47 miles.

From the Bill of Portland to St. Catherine point the course is E. by S. $\frac{3}{4}$ S. 44 miles; and thence to Beachy head, E. by S. $\frac{1}{2}$ S. 59 miles. In bad weather St. Catherine point, conspicuous from its lighthouse, should be given a good berth, to avoid the race and overfalls near it. Between St. Catherine point and Beachy head, by keeping outside the depth of 20 fathoms, vessels will pass south of the Owers, and ensure the true channel tide.

START BAY is within the Skerries, and its shore is bordered by a beach 5 miles in length, extending from Haulsands to Street head. The whole of this bay, within the clearing marks for the Skerries, affords good anchorage in 7 to 8 fathoms, over sand and gravel, except in strong easterly winds and within half a mile of Start point, where the ground is rocky; and the tide, which runs to the southward nine hours

* These lights are all of equal height, 113 feet above high water, and *revolve* every 20 seconds. See Channel Pilot, Part II, page 211.

out of the twelve, might set a weak-handed vessel on shore, in getting under weigh before she is fairly under canvas, if too close in.

Start point shelters Start bay with the wind to the westward of S.W., but if it should veer to the southward of S.S.W., weigh and run for Dartmouth or Torbay, as a heavy sea is thrown in by south-easterly gales. In the northern part of the bay there is a sunken rock, with $3\frac{1}{4}$ fathoms over it, called the Earlstone, lying upwards of half a mile W. by S. $\frac{1}{2}$ S. from Combe point. The Outer Combe rock, 11 feet above high water, on with the Blackstone at the entrance of Dartmouth, N.E. by E., leads eastward of the Earlstone; and the boat house in the centre of Blackpool bay well open of Stoke point W.N.W. leads to the southward.

Start Bank, lying 7 miles to the southward of Start point, is about a mile in length north and south; and though the least known depth is 29 fathoms, the sea over it is much agitated during spring tides.

The soundings off the Start are somewhat irregular; there being from 2 to 3 fathoms more water near the land than in the offing, and farther southward the depth again increases, in about the same proportion.

DARTMOUTH HARBOUR.—From Start point towards Dartmouth the coast is generally low, rising gradually in the interior. The entrance to Dartmouth is 5 miles S.W. by W. of Berry head, and its position may be recognized from seaward by the granite peaks or tors, which break the outline of the Dartmoor range. The most remarkable of these are the Haytor and Rippon tor; the latter, 1,525 feet above high water, being easily distinguished from the former by its single culminating point or cairn; whilst Haytor on the contrary presents a forked or jagged appearance. Rippon tor bearing N. $\frac{1}{2}$ W. leads to the entrance of the harbour, which, as the land is approached, will be more distinctly recognized by the tall square tower of Stoke Fleming church, standing conspicuously on high ground about $1\frac{3}{4}$ miles westward of the entrance, and also by the Mewstone, a remarkable rocky islet, three-quarters of a mile to the eastward.*

The town of Dartmouth stands on the right bank of the estuary of the river Dart near its embouchure in the English Channel, where it forms a spacious harbour capable of containing a large fleet of ships of the greatest draught. The entrance to the harbour is narrow, and protected on its west side by a battery, built on the site of an ancient castle, whence in former times a chain was extended to a castle on the opposite shore of the entrance, for the purpose of defence.

* See Admiralty Plan of Dartmouth Harbour, with Views, No. 2,253; scale, $m = 10$ inches.

The picturesque old church of St. Petrox, with the castle adjoining it, stands out in bold relief on the brink of the precipitous rock at Battery point, on which is a new fort, at the western side of the entrance ; and a low square tower, Kingswear castle—the sea face of which is white—also near the water's edge on the opposite or eastern side. Blackstone rock, 8 feet above high water, lying a cable's length S. by E. $\frac{1}{2}$ E. from Blackstone point, is also a useful object as a clearing mark for the shoals near the entrance.

Although the entrance to Dartmouth is only 220 yards wide from rock to rock, it opens out within the points into a safe and commodious harbour of considerable capacity for vessels of any draught. Outside the points the character of the coast both east and west is a steep and rocky shore, dangerous to approach in boisterous weather and fatal to be cast upon, without one yard of sand or shingle on either side for miles, on which a vessel could be safely beached.

This port affords great facilities for obtaining supplies of all descriptions, including excellent water. There are good building yards, with two patent slips and a powerful steam tug ; and, as there is a rise of tide of 14 feet, great convenience for steamers to coal alongside New Ground quay, which only dries at low water springs. The patent slips are, one 450 feet, the other 250 feet in length, and capable of taking vessels of large burthen.

The number of vessels belonging to the port in 1866 amounted to 286, representing 26,022 tons, and 7 small steamers. The river Dart is navigable by vessels of 150 tons, as far as Totness, a distance of 10 miles. The principal articles imported are timber, grain, coal, sugar, &c. ; and exported, cider, potatoes, stone, oak and elm timber. In 1861 the population of Dartmouth was 4,444.

LIGHTS.—On the northern or Kingswear side of Dartmouth harbour, is an octagonal tower from which at an elevation of 85 feet above high water, is exhibited a *fixed* light, showing white over the fairway entrance to the harbour through an arc of $9\frac{1}{2}^{\circ}$, between the bearings from seaward of N. $\frac{3}{4}$ W. and N. by W. $\frac{1}{4}$ W. ; *red* between N. by W. $\frac{1}{4}$ W. and the land to the north-east, over the shoals of Castle ledge and Kettle point ; and *green* between N. $\frac{3}{4}$ W. and the land to the south-west over the Pin rock and Checkstone shoals. In clear weather the light should be seen from a distance of 11 miles.

At the distance of 110 feet seaward of the above light, is a staff, from which, at an elevation of 70 feet above high water, a *fixed* white leading light is exhibited ; and the two lights in line, N. $\frac{3}{4}$ W. leads through the middle of the fairway channel.

After passing between Castle and Kettle points, a *fixed* white light near the Coast-guard station, at the southern end of the town of Dartmouth

will indicate the fairway to the anchorage ; this light will show *red* over the shoals on the north side of the harbour, and *green* over the shoals off One Gun point on the south side.

Beacon.—A beacon or day mark in the form of a truncated pyramid 80 feet high, stands on the high land, about 500 feet above the sea, about half a mile N.E. by N. from the outer Froward point, at the eastern side of the entrance to the harbour.

Pilots.—Many experienced pilots belong to the port, and during the summer months, from daylight till dark, they cruise outside the entrance of the harbour.

ANCHORAGE.—Outside the entrance of Dartmouth harbour, within Blackstone and Froward points, is a small roadstead called the Range, which may be used as an occasional anchorage. The holding ground is excellent, with water of moderate depth, and little tide ; but as it is open to winds from S.S.E. to S.S.W., it should not be resorted to as a place of refuge. With strong southerly winds on an ebb tide, the sea breaks heavily across the roadstead ; and indeed there is generally a heavy swell, with anything like bad weather, in the offing. If caught there with the wind from the southward, and blowing hard, a vessel has no alternative but to slip and run into the harbour.

There is good anchorage in the harbour anywhere above One Gun point, the usual place being near the town off the New Ground in 22 feet water, which is to be preferred if a vessel is to remain any time, as most convenient for obtaining supplies, and being entirely out of the way of vessels entering ; but if the harbour is only resorted to for temporary shelter, or for the sojourn of a day or two, the anchorage lower down is the best, in 7 to 10 fathoms between Old Dartmouth castle and Warfleet cove, from which position it will be comparatively easy for a sailing vessel to get to sea on a flood tide, when it would be scarcely possible to do so from the upper anchorage.

DANGERS on WESTERN SHORE.—There are many dangerous rocky patches which render the approach to Dartmouth somewhat critical to a stranger. It will be well, therefore, to call attention to their nature and position, with the best marks for avoiding them, before any general directions for sailing in and out of the harbour are given.

Combe Rocks.—A group of rocks lie immediately off Combe point, and many of them are at all times above water, and all of them show at low tide ; the outer rock of the group, the Outer Combe, lies rather more than a cable from the shore, and dries at half tide. When seen it may be approached without fear, having deep water all around it, and indeed, at all times in daylight, from its proximity to the Old Combe rock always

above water, and from which it is distant scarcely half a cable to the eastward.

Mag Rocks.—A quarter of a mile N.E. by N. from the Outer Combe rock, a succession of high heads show themselves from half ebb to low water; these are called the Mag or Mica, inside of which no vessel should venture. Kingswear castle open of Blackstone point, N.E. $\frac{1}{4}$ N., leads eastward of these heads as well as the Outer Combe, and all dangers between Combe and Blackstone points.

Homestone Rocks.—A patch of rocks, dangerous even to small vessels, lies a quarter of a mile E.S.E. from Combe Point, leaving a safe deep water channel between them and the Combe rocks. The highest head of the patch is called the Homestone, over which there are not more than $4\frac{1}{2}$ feet at low water. From it Kingswear castle is on with the highest point of the Blackstone rock, N.E. by N.; and a high and remarkable needle rock at Combe point is in line with Stoke Fleming church. Kingswear castle open east or west of Blackstone rock, clears it on either side; and Stoke Fleming church in line with the extreme of Combe point, leads to the southward. A buoy painted with black and white rings is moored about half a cable south-eastward of the rocks.

About 127 yards N.E. of the Homestone buoy is a patch, with only 17 feet at low water, which should be carefully avoided by vessels of large draught. St. Petrox church just open of Blackstone point N. by E. leads half a cable to the eastward. }

Pin Rock, about half a cable in length, lies a third of a mile eastward of Homestone rocks, with Blackstone rock and point in a line. The least water on the rock is $4\frac{3}{4}$ fathoms, so that it can only be deemed a danger to vessels of large draught, or when a heavy sea is running. There are from 7 to 10 fathoms close to and around it.

In a line between Pin and Blackstone rocks, and a quarter of a mile distant from the latter is a small rocky patch with 25 feet water.

Blackstone Rock has already been alluded to, but care should be taken when passing it, to avoid a sunken rock about 70 or 80 feet off its eastern point. Although small vessels with local knowledge occasionally run between Blackstone rock and point, it is attended with considerable risk, for a shoal-head of only 5 feet water lies nearly in mid-channel; the following observation however, may perhaps be useful, viz., that except the rocks off Blackstone point nothing dries at low water; and as there is a rise of 16 feet, a vessel may in case of necessity use this channel at or near high water, taking care, in doing so, to keep closer to the rock than the point.

Checkstone Rock.—A group of rocks, some never covered, and most of them dry at low water springs, extend a considerable distance from the shore a little to the southward of Battery point, and as the narrowest part

of the channel is approached, the outer one, called the Checkstone, with only a foot water over it, greatly encroaches upon the fairway. A black and white chequered buoy marks its position, but as there are as little as 13 feet water to the eastward of it, the buoy should not be too closely approached. Kingswear point touching Battery point N. by W. $\frac{3}{4}$ W., leads eastward of the 13 feet patch.

A small detached rock lying near Dartmouth castle, but too close in to be of much importance, completes the dangers on the western side of the entrance from Combe point to the anchorage.

DANGERS on EASTERN SHORE.—The outlying dangers on the eastern shore of the entrance to Dartmouth are scarcely less in number and importance than those which have already been described on the western side.

The Mewstone, a rocky islet 125 feet above high water, lies about $1\frac{1}{2}$ cables off shore, a little to the eastward of Outer Froward point, and is steep-to on its eastern side, but the channel between it and the land should never be attempted. If from any cause a vessel is carried through by the tide, she must be kept as nearly as possible in mid-channel, as the rocks dry off for a considerable distance on both sides.

The Verticals.—Beyond the many high rocks extending from the Mewstone in a westerly direction, is a ledge of dangerous rocks, running parallel with the coast a full quarter of a mile West of the Mewstone. Some of these rocks which are called the Verticals, from their high and precipitous sides, show at low water.

The west rock of the Verticals dries only at the lowest tides, and as there is a considerable rise of the ground with only 24 feet water on it, upwards of a cable's length to the westward, it will be prudent, from the suspicious nature of the bottom, and the set of the flood tide, to give this locality a wide berth; Kingswear castle well open of Inner Froward extreme point N.N.W., leads westward of the 24 feet rise.

As the water suddenly deepens to 10 fathoms to the southward of the Verticals; the lead is of little value; but in daylight a good clearing mark is, the East Blackstone well open of the Mewstone E. $\frac{1}{4}$ N. which will also lead to the southward of all the dangers off Dartmouth. The East Blackstone, the Mewstone, the high rock near it south of the Shooter, the Verticals, the Pin (nearly), the Homestone, and the rocks off Combe point, lie in line; as do also the Mewstone, the Shooter, the Bears tail, the Castle ledge, and the Blackstone.

Bears Tail Rock lies rather more than half a cable's length south of Outer Froward point, and dries at low water; but as it is out of the proper track of vessels, it needs no farther notice than to point out as a warning to small craft, or boats intending to run between the Mewstone and the

shore, that Kettle and Inner Froward points in one lead over it, as do also the highest peaks of the Shooter and Mewstone.

Old Castle Rock.—A patch of sunken rocks lies upwards of a quarter of a mile westward of Outer Froward point, and a little less than that distance from Inner Froward point, with a good channel for small vessels inside it. On this patch, however, there are several shoal heads, two of which require to be particularly noticed. The inner head, called Old Castle rock, has only 4 feet water, and from it the ruin of the old castle at Dartmouth, which stands at the southern end of the town, is seen touching Battery point.

Castle Ledge, the outer head of the rocks off Inner Froward point, has only 8 feet water, and lies with the lighthouse under Beacon hill, just touching Kettle point; and the peak of the Mewstone over the south tangent of the Shooter.

The Mewstone peak open of the Shooter leads to the southward; and the castle flag-staff in line with Mount Boon house, or Battery and Kingswear points touching N. by W. $\frac{3}{4}$ W. leads to the westward. The latter is the fairway mark up to Battery point, and leads eastward of the Checkstone. Beacon hill in line with Kingswear castle and outside Inner Froward point, N.N.W., clears the tail of the Verticals, the Bears tail, and leads inside old castle rock.

A black buoy is moored half a cable outside the Castle ledge.

Kettle Rock.—From Castle ledge to Kettle point the shore is clear and bold, but 60 feet outside the point is a small sunken rock, with only 3 feet water over it. The Kettle rock, which dries at low water, lies inside the point, close to the shore.

TIDES.—It is high water, full and change, in Dartmouth harbour, at 6h. 16m.; ordinary springs rise 14 feet, and neaps 10 feet. At Ditsham it is high water 6 minutes later than at Dartmouth, and the rise is the same. At Totnes 24 minutes later than at Dartmouth; springs rise $10\frac{3}{4}$ feet, neaps $6\frac{1}{2}$ feet. At Blackstone rock and Castle ledge buoy, or anywhere within the Range, the stream turns with the tide on shore, but at the Homestone about $2\frac{1}{2}$ hours later.

From half a mile to a mile outside the Homestone, the flood sets to the southward of the Mewstone; but at the Homestone its direction is about E.N.E. for Inner Froward point until within a few yards of the shore, gradually becoming weaker as the land is approached. Thence it turns to the southward, running close in-shore inside the Castle ledge, acquiring strength as it rounds Outer Froward point, which having passed, it sweeps to the eastward inside the Mewstone, the rate varying from one to 2 knots.

At Castle ledge buoy, the first of the flood by the shore sets about

S.E. by E. direct for the Verticals, and meets the last of the Channel ebb as soon as those rocks are passed. The flood splits at Blackstone rock, anywhere within which it curves gradually outside the Checkstone buoy towards the entrance, and runs sluggishly until within the points.

The principal eddy on the flood is that which runs along the eastern shore round the Froward points, but there is also a slight eddy running down close to the rocks between Brook hill and Kettle point. Along the western shore the tide is weak on the flood outside the harbour; but a strong eddy runs inside the points, which commences 2 hours after low water by the shore, from the coast-guard station to One Gun point.

The ebb sets obliquely across the harbour, from the ferry slip at Kingswear towards the coast-guard station, which stands in the bight about half-way between the town and One Gun point; thence it runs out between the points, and sets in a southerly direction until past Castle ledge, where it is met by the offing ebb, with which it mingles, and is deflected to the westward running outside the Homestone.

There is a strong eddy on the ebb in the bight from Kittery corner to abreast One Gun point, of which the pilots are glad to avail themselves in light southerly winds, when it would be difficult to reach the anchorage without it. A weak eddy tide will also be found between One Gun point and St. Petrox, but it extends only a few yards off shore. Both the strength and breadth of the eddies depend much upon the velocity of the stream, ever varying according to the state of the tide and the freshes, and which require at all times much caution and a pilot's experience when entangled in them.

DIRECTIONS.—When seeking refuge in Dartmouth harbour in a gale between S.W. and S.E. if in Start bay or to the westward of Dartmouth, keep about a mile from the shore, and run to the eastward till the entrance opens out, which it will do on a N.E. by N. bearing; continue on till Dartmouth castle is in line with a large house on Mount Boon, bearing N. by W. $\frac{3}{4}$ W.*—or Battery and Kingswear points touching—which will lead in the fairway for the entrance.

When about $1\frac{1}{2}$ cables from Battery point, steer midway between the points and anchor in from 7 to 10 fathoms off Warfleet cove a quarter of a mile within the entrance. At night keep in the sector of white light, between the bearings of N. $\frac{3}{4}$ W., and N. by W. $\frac{1}{4}$ W., and when the leading light is seen, bring it on with the upper light N. $\frac{3}{4}$ W., and continue on through the fairway channel of the entrance, until well within the sector of white light on the Dartmouth side, when steer for it, and select an anchorage as convenient.

* See View on Chart.

If to the eastward of Dartmouth with a south-westerly wind, run for Torbay, the only secure anchorage in bad weather between Dartmouth and Portland.

Sailing vessels sometimes experience considerable difficulty in getting in and out of Dartmouth, partly owing to the perplexing eddies at the entrance, but more from the baffling winds which blow off the high lands, sometimes with considerable violence, especially if the wind be westward of N.W., when it requires all the experience of a skilful pilot. The true winds are N.W. and S.E., and as a general rule, in moderate weather, with the wind between N.W. by N. and N.N.E., and S.W. and S.E., a vessel will be found pretty well under command.

The channel between Combe rocks and the Homestone, under some circumstances, may be used with advantage, particularly with scant westerly winds. Turning in or out of the harbour with baffling flaws, the truest wind will be found on the opposite side of the Range from which it blows.

A stranger should not attempt to work into the harbour, particularly at night, without a pilot; but by attending to the marks in the day time, with a fair wind, or in a steamer; or at night by keeping in the white sectors of light, there can be no great risk in running almost in any weather.

The river above Dartmouth, being winding and intricate, is only used by vessels drawing less than 10 feet, and to navigate between its banks and shallows, local experience is needed. The Anchorstone, a half-tide rock, lies $1\frac{1}{2}$ miles above the town, in a direct line between Ditcham Rectory boat-house and Greenway boat-house, one third over from the west bank; on its western side are 8 feet water, and on its eastern 12 fathoms.

In a sailing vessel great caution should be observed, particularly in light winds, when leaving the harbour and bound to the eastward, not to be caught by the flood tide near Outer Froward point, as it would be likely to set the vessel either inside the Mewstone or on the Verticals. In most cases, without a commanding breeze, she would have to trust to her anchors in foul ground. When the East Blackstone is open south of the Mewstone, safety is pretty certain; the latter islet may be rounded to the southward within a moderate distance.

The COAST from the Mewstone trends in a north-east direction $4\frac{1}{2}$ miles to Berry head, with high undulating land. To the northward it rises to a height of 490 feet one mile within Sharkham point, the pitch of which is 213 feet high. At Scabbacombe the summit of the cliff is 420 feet above high water; again at Downend point, where the cliff is 200 feet high, the land rises, half a mile in the interior, to 510 feet. Between the

Mewstone and Berry head the shore is dangerous to approach within half a mile, there being in this space the following steep and dangerous rocks, having 6 and 7 fathoms water near them.

East Blackstone Rock, 10 feet above high water, lies a mile S.W. by S. from Downend point, but has no outlying dangers.

Boothfield Rock, with 9 feet water, lies off the south-eastern extreme of Downend point, about 2 cables from the shore. A projecting rocky point, half a mile to the southward of Sharkham, open of Downend, N.N.E. $\frac{3}{4}$ E., leads to the eastward.

Wimble Rock, with only $3\frac{1}{2}$ feet water, and steep-to, lies about a third of a mile off shore, a little south of Downend point. From it Start lighthouse is in line with the East Blackstone, and the north-east tangent of Downend point is on with the highest part of Scabbacombe cliff. The lighthouse open east of the East Blackstone, leads eastward of the rock ; and open west, leads between it and the land.

Mudstone Ledge lies S.S.W. $\frac{1}{2}$ W. a mile from Berry head, and about half that distance eastward of Sharkham point, and on its outer end, there are $4\frac{1}{2}$ fathoms. Hope Nose well open of Berry head N.N.E. $\frac{1}{4}$ E. leads to the eastward.

Cod Rocks are two steep and rocky islets, 50 feet high. The outer one bears S. by W. $\frac{3}{4}$ W. a third of a mile from Berry head, and is a quarter of a mile off shore ; there is no channel between them and the land.

DIRECTIONS.—When navigating between Start point and Berry head keep the latter open of Downend point bearing N.E. to avoid the Skerries. When abreast the Mewstone, keep Hope Nose open of Berry head N.N.E. $\frac{1}{4}$ E., and it will lead eastward of all the dangers between Dartmouth and Berry head.

Between Dartmouth and Berry head the stream turns in-shore an hour earlier than in the offing.

TORBAY lies between Berry head and Hope Nose, distant $3\frac{3}{4}$ miles, N.N.E. $\frac{1}{4}$ E., and S.S.W. $\frac{1}{2}$ W. of each other. Berry head, a limestone cliff, steep-to and nearly vertical, is 180 feet high, with a flat or table summit, and may be seen in clear weather from a distance of 20 miles ; quarries are extensively worked on its northern face. Near Hope Nose, on the northern shore of the bay, are three rocky islets, named the Ore-stone, with a small rock half a cable from its south point, the Thatcher, and Flat rock ; and to westward of these are the Morris Rogue, East Shag, and West Shag rocks. The bay affords good shelter from westerly winds, but the mariner is warned against being caught in it by a south or south-easterly gale as they throw in a heavy sea. The three tidal harbours

of the bay, viz., Brixham, Paignton, and Torquay, should not be run for with on-shore gales.*

The fishing town of Brixham, with a population of more than 7,000, stands on the southern shore of the bay, $1\frac{1}{4}$ miles within Berry head, and has a pier harbour dry at low tide, but with 10 to 15 feet in it at high-water springs. Its surplus dues partly defray the cost of a breakwater, about a quarter of a mile eastward of the entrance, which extends 250 yards from the land, affording shelter to small vessels. There are several shipwrights' yards at Brixham, and upwards of 24,000 tons of shipping belong to the port, besides a large fleet of trawlers, averaging from 35 to 50 tons. A large reservoir of fresh water has been formed by Government for the use of vessels in the bay, with pipes to the eastern pier head.

On the western shore of Torbay, and on the north side of Roundham point, is the small pier harbour of Paignton, which has from 10 to 14 feet in it at high water springs, but dries at low tide.

The town of Torquay stands on the northern shore of the bay, at the meeting of two deep valleys. Its pier harbour dries at low tide, but has from 10 to 15 feet in it at high water springs.

LIGHTS.—A small *fixed* red light is exhibited from an iron stand, 20 feet above high water from the western pier head of Brixham harbour. A *fixed* red light is also shown at 15 feet above high water from the southern pier head at Torquay. Both lights may be seen in clear weather from a distance of 5 or 6 miles.

The RIDGE, the only foul ground in Torbay, is a small rocky patch with $3\frac{1}{4}$ fathoms least water on it, from which the Thatcher is on with Hope Nose, N.E. by E. $\frac{1}{2}$ E., and Smoky House mill (a ruin) is in line with the western fall of the red cliff on the southern side of Roundham point, N. by W. $\frac{1}{4}$ W.

ANCHORAGE.—Avoiding the ridge, the whole of Torbay affords good anchorage in 6 or 7 fathoms over mud and clay, sheltered in all winds from N.E., round by the north, to S. by W., and even to S.S.E. if a berth be taken up in-shore on the southern side of the bay, but it is open to the eastward, and south-easterly gales send in a heavy sea; yet Brixham road having an underset to windward, that strengthens with the wind, affords easy riding.

Hence this is a favourite anchoring ground, and more shelter will be found from south-westerly winds with Brixham church and pier head in line bearing about S.W., and Berry head between South and S.S.E.

* See Admiralty Plan of Torbay, No. 26; scale, $m = 4$ inches.

Large ships should not anchor farther southward than to have Paignton church on with Roundham point, N.W. $\frac{3}{4}$ N.; nor farther westward than the high part of the Thatcher over the narrow neck of Hope Nose, N.E. $\frac{1}{4}$ N. Here they will be sufficiently out to secure an offing, in case of a south-east gale. Should a vessel be obliged to run on shore in the south-west angle of the bay, there is a little bight called Elbury cove, a beach sheltered by rocks; by running for this many crews have been saved, and the vessels subsequently got off; while others driven on shore to the northward have become total wrecks.

Life Boats.—A life boat is stationed at Brixham, and another at Torquay.

TIDES.—In Torbay it is high water, full and change, at 6h. 0m.; springs rise $13\frac{1}{2}$ feet, and neaps 10 feet.

DIRECTIONS.—Entering Torbay from the southward, Berry head, which is steep-to, may be rounded at any convenient distance. With the exception of Shoalstone point, off which a reef extends about a cable, the whole of the south shore of the bay is clean, and the soundings regular.

In running for Brixham harbour by day, vessels must keep outside the red buoy, which marks the outer end of the breakwater; and if making for the harbour from the eastward at night, keep well to the northward of Shoalstone point, until the red light on the pier opens out; the light then kept S.W. will lead in clear of the end of the breakwater.

A vessel bound into the bay from the northward may, if necessary, pass mid-channel between the Orestone and the Flat rock off Hope Nose, as the passage has from 5 to 9 fathoms water in it. The Orestone kept its own length open of the Thatcher, E. $\frac{1}{2}$ S., clears the rocks and foul ground on the northern side of the bay; and this bearing with the whole of Torquay pier open of Beacon hill, N.N.E. $\frac{1}{2}$ E., marks the anchorage in Torquay road.

BABBACOMBE BAY is $1\frac{1}{2}$ miles northward of Hope Nose, and in westerly winds affords good anchorage in 4 to 5 fathoms over sandy bottom; thence to Portland Bill the anchorage off all the small towns is sheltered only from northerly winds.

TEIGNMOUTH, at the mouth of the river Teign, is half way between Torbay and Exmouth, N. by E. $\frac{1}{2}$ E. $4\frac{1}{2}$ miles from Hope Nose, and 39 miles N.W. by W. $\frac{3}{4}$ W. from the Bill of Portland. The river falls into the sea through a narrow channel, obstructed by a bar which nearly dries at low water springs, and is ever changing from the effects of the strong freshes and southerly gales. From the Ness on the south side of the entrance to Ferry point on the north side, the distance across at high water is only a quarter of a mile. The Ness is a beautiful headland of

red sandstone clothed with verdure, rising boldly from the water's edge to the height of 174 feet. Ferry point, which terminates the promenade called the Denn, is a long low tongue of loose shingle, changing with every gale of wind.*

The channel into the river is nearly straight, about half a cable's wide at low tide, and the most water will be found on the south side. It lies between two sands, which uncover considerably. Spratt sand, on the north side of the channel, is by far the most extensive, and the high head of fine shingle heaped up near its outer end, but which changes with the weather, is called the East Pole. The Pole or Ness sand is on the southern shore, and dries above a quarter of a mile outside the point.

There are no rocks on the north side of the channel, but many patches of large loose blocks of red sandstone extend the whole way round the Ness up to the anchorage in Shaldon pool, the limits of which are imperfectly pointed out by two rough buoys painted red; the western patch is called the Bench rocks.

As the bottom is entirely free from rocks at the entrance, a vessel can anchor outside the bar according to her draught; but it may be well to observe that the shoal water extends a long way outside the sand heads, and as little as 12 feet may be expected at a third of a mile from the Ness. To ensure 18 feet at low water, Berry head must be kept open of Hope Nose, which will lead upwards of half a mile outside the sand heads, and be found a safe turning mark for a stranger between Torbay and the harbour.

Apart from the attractions of Teignmouth as a watering place, with its railway station in the heart of the town, it is fast becoming a port of considerable commerce. The population in 1861 was 7,000. In 1866, there belonged to the port 70 sailing vessels representing 8,125 tons, and 2 small steamers. A steam tug is attached to the port, and there are two patent slips.

A Life Boat is stationed on the Denn.

LIGHTS.—The lighthouse inside Ferry point on the south-west end of the Denn, exhibits from an elevation of 34 feet above high water a *fixed* red light, which may be seen in clear weather from a distance of 6 miles, and serves to point out the position of the harbour at night; a small shifting *red* light is placed in one of the houses behind it. The two lights in one clear the rocks off the Ness and the highest part of the Pole sand, and lead up to the fairway, the approach to which can alone be estimated by a bearing off the land and attention to the lead.

* See Admiralty Plan of Teignmouth, No. 2,213; scale, $m = 15$ inches.

TIDES.—It is high water, full and change, at Teignmouth at 6h. 0m.; springs rise 13 feet, and neaps 9½ feet. Outside the bar the time of high and low water is about 25 minutes earlier, and there may be six inches more rise and fall.

On the bar, the flood stream makes into the river nearly half an hour after low water by the shore, and before the banks are covered sets up the channel with a velocity of from three-quarters to 1½ knots; but as the tide rises its direction is over the Spratt sand, which should be allowed for when working into the harbour with light winds.

The tide has no great strength until near Ferry point, round which it sweeps from half tide to nearly high water at the rate of 4 to 5 knots, causing strong eddies near the beach on both sides. Inside Ferry point, at half tide, the flood flows over the east end of Salty flat, and at or near high water makes nearly a straight course from Ferry point to the bridge, running from half to 1½ knots.

In much the same way the course of the ebb stream depends entirely upon the state of the tide. From the bridge the first quarter ebb runs over the low part of Salty flat for Shaldon pool; but as the tide falls, or a little after half ebb, it drives through the channel with considerable velocity, much influenced by the quantity of fresh water in the river. Under ordinary circumstances its average rate is as follows:—From the Swing bridge to the moorings, one to 1½ knots; below the moorings, 3 knots; at Ferry point, 5 knots, slackening immediately after passing the Ness; and over the bar, from one to 2½ knots.

There is no eddy on the ebb on the western shore below the Bench rocks, for the true stream runs close past them, as it does also on the opposite side near Ferry point. On the bar the first and second quarters ebb set about E.N.E.; and after half tide S.E., meeting the true tide a short distance outside the bar.

DIRECTIONS.—It would be most hazardous to trust to Teignmouth for refuge in bad weather, for the ground swell which generally precedes a southerly gale soon becomes a heavy breaking sea as the wind increases. If unable to cross the bar, which would be attended with much danger and difficulty, the only alternative is to secure an offing as quickly as possible, bearing in mind that no shelter is to be found between Dartmouth and Portland road.

As the sands are constantly shifting, no leading marks can be depended on with certainty; but as buoys are not laid down to mark the channel at the entrance, it may be useful to know that the south arch of the bridge, or the junction of the staging with the masonry, which is very observable, just shut in with the outer end of Ferry point, will lead over the bar, and towards

Spratt sand. This course should be continued until the lighthouse is in line with the coast-guard flag-staff; then haul over for the Shaldon shore, steering for the south house in Shaldon, until the north-west house or tangent of the houses comes on with the above arch, which will lead up to Shaldon pool in mid-channel, and abreast the fairway buoys on the starboard hand.

From this position the channel to the moorings off Teignmouth, where vessels may ride in from 10 to 12 feet at low water, is marked by seven buoys on the edge of Salty flat, viz., four red, one striped black and white, one black, and one red, all of which must be left on the port hand. A large red barrel buoy is placed at Ferry point; but as the sand at low water dries for a short distance beyond it, give it a tolerable berth in rounding the point. There is room for a few small craft in Shaldon pool, out of the way of vessels entering the harbour; the best berth is abreast the south end of the town a little above the Bench rocks, out of the strength of the tide.

A swing opening through the bridge admits vessels drawing 11 feet to the upper part of the river, but the principal part of the traffic is carried on in barges; for these, and even small vessels, there is water communication the whole way to Newton, and a channel has been cut and buoyed for the purpose.

DAWLISH is a small but fashionable watering place between Teignmouth and Exmouth, and in 1861 its population was 4,733. The town is in one of the numerous valleys for which this coast is celebrated, and with the parish church and a few villas, stands half a mile from the sea.

The Dawlish rock, with 11 feet water, lies abreast the town, nearly half a mile off shore, with Exmouth church just open of Warren point, N.E. by E. $\frac{1}{4}$ E., and Mamhead tower and coast-guard flag-staff in line N.W. $\frac{3}{4}$ W.

EXMOUTH HARBOUR.—The river Exe falls into the sea at the bottom of Lyme bay, the extreme points of which are Hope Nose and the Bill of Portland. A floating dock 530 feet long and 300 feet broad has lately been opened at Exmouth, and opening from it a dry dock is in course of construction 250 feet long by 58 feet in breadth.*

The canal leading to Exeter commences a mile below Topsham, and is 5 miles long, 13 feet deep, and 30 feet wide, terminating in a lock and basin, the first 120 feet long, and 28 feet wide; and the basin, which is opposite the quay at Exeter, 917 feet long, 18 feet deep, and from 90 to 110 feet wide. Vessels must lighten to 12 feet before they can enter the canal. At Topsham there is a dry dock, 190 feet long, 42 feet wide, 32 feet between

* See Admiralty Plan of Exmouth Harbour, No. 2,290; scale, $m = 6$ inches.

gates, and 10 feet over sill at high-water springs, and 7 feet at high water neaps ; there is also a steam tug.

The mouth of the river Exe bears N.E. $\frac{1}{2}$ N. $12\frac{1}{2}$ miles from Berry head, and N.W. by W. $\frac{1}{4}$ W. 35 miles from the Bill of Portland. Within the mouth is the harbour of Exmouth, which is difficult of access at all times, unapproachable in a heavy sea, and should not therefore under any circumstances be depended upon for refuge in stormy weather. The town of Exmouth is a mile within the entrance, and its population in 1861 was 7,000.

The approach to the entrance is between a long sandy point, called the Warren, on the western side, extending $1\frac{1}{2}$ miles from Langstone point, and Orcomb point on the eastern side, rising about 60 or 70 feet above high water. The Warren is covered with coarse grass, and abounds with rabbits. The channel is very narrow, with a long shallow bar of broken water, bounded on its north side by a fringe of dangerous rocks uncovering only at low water, and on the other side by far spreading treacherous sands.

Fair-way Buoy.—A buoy striped black and white horizontally, with a beacon, is moored in 6 fathoms water, a mile outside the entrance, with Exmouth church in line with the south-eastern house on Beacon hill, N.N.W. $\frac{1}{2}$ W. ; and Mamhead tower just open north of Langstone point, W. by N. $\frac{1}{2}$ N. ; the tower stands conspicuously on the high land to the southward of the obelisk on Great Haldon hill.

A Life Boat is stationed at the entrance of the harbour.

Orcomb Ledge extends nearly a quarter of a mile from Orcomb point ; and as no buoy marks its extent, it is dangerous to vessels entering the harbour. The rocks extend to the eastward as far as Straight point, and in the direction of the harbour channel for three-quarters of a mile, and dry at half tide. Various names have been given to the salient prongs of this ledge, viz. :—Orcomb ledge, Flat ledge, Page ledge, Double ledge, Long ledge, and the Congar rocks ; and five black buoys mark their outward edges.

Days Ledge is a small patch of rocks, which dries at low water. It lies on the eastern side of the channel, at the point under Gun cliff, near the coast-guard station, and is much in the way of small vessels ; but its position is sufficiently pointed out by a black buoy placed well outside it.

Checkstone Ledge.—A cluster of flat rocks, which dry only at spring tides, lies a little above Days ledge, on the western side of the channel, and its north extreme is marked by a buoy, with black and white vertical stripes. A perch is also erected upon a small rock called the Checkstone, which is considerably within the ledge, and out of the fairway.

Pole Sand extends $1\frac{1}{2}$ miles outside Warren point parallel to the opposite shore, and dries at low water to abreast Orcomb point. This sand narrows

the entrance considerably, and is marked by three white buoys with black and white vertical stripes, besides the one on the Checkstone ledge.

SWATCHWAY.—Between the Warren sand and eastward of Warren point and the Pole sand, there is an intricate channel only available at half tide for boats and small vessels under 6 feet draught, if well acquainted with the place, and in fine weather; for with strong westerly winds, which almost always cause a swell outside, there is certain to be a heavy breaking sea on the Mounster sand. It is also a convenient passage for avoiding a long and laborious pull round the Pole and against a strong ebb tide over the bar.

ANCHORAGE.—A vessel can anchor outside the entrance to Exmouth anywhere near the fair-way buoy, waiting tide according to her draught and the state of the weather, keeping eastward or westward of the buoy, according to the direction of the wind.

The best anchorage within the entrance is on the western side of the harbour above the town, in a hole of deep water and comparatively slack tide, called the Bight, which is formed between the low water sands on the western shore, and a high hard gravel bank, Bull-hill bank, to the eastward. A black buoy marks the S.W. extreme of Bull-hill bank, abreast which vessels may moor in 3 fathoms at low water.

TIDES.—In Exmouth harbour it is high water, full and change, at 6h. 21m.; springs rise $12\frac{1}{4}$ feet, and neaps $8\frac{1}{2}$ feet. At Topsham lock the tide is 15 minutes later; the rise at springs being only one foot less, and at neaps the same as in the harbour. The tide begins to rise at Topsham about 2 hours after low water at Exmouth, when it has risen nearly a foot at the latter place.

Soon after low water, the flood makes at the entrance, and sets about a knot, fairly up the channel until the banks are covered, increasing to $2\frac{1}{2}$ knots abreast the church, and to 5 knots off Ferry point, where it has acquired its greatest strength, which decreases considerably as the Bull-hill bank is approached.

The ebb within the harbour turns with the tide by the shore, and for the first two hours sets across the Warren and Pole sands; over the former it runs $2\frac{1}{2}$ knots until past Warren point, when its strength decreases, and it crosses the Pole at the rate of little more than a knot. The stream turns to the eastward when free from the influence of the harbour shoals.

As the banks uncover at about $2\frac{1}{2}$ hours ebb, the tide sets fairly through the channel with considerable strength, at least 5 knots, abreast the Ferry; it crosses the outer end of the Pole sand at the rate of about $1\frac{1}{2}$ knots, but when clear of the shoals, it scarcely runs a knot.

Throughout the ebb by the shore, between Exmouth bar and Straight point, the direction of the stream is E.S.E.; the tide is rotatory at that point.

DIRECTIONS.—Approaching the entrance of Exmouth harbour from the southward bring Exmouth church to bear N.N.W. $\frac{1}{2}$ W., or in line with the south-east house on Beacon hill, and this mark will lead up to the fair-way buoy.

The entrance should not be attempted without a pilot, but with a leading wind, if compelled to do so, leave all the black buoys on the starboard and the striped black and white buoys on the port hand; but the channel is winding, and under any circumstances as little as 5 feet at low water must in all probability be crossed. The atmospheric engine chimney at Starcross (a tall and conspicuous red tower,) in line with Exmouth point, bearing N.N.W. $\frac{3}{4}$ W., will lead westward of the first striped black and white buoy on the Polesand, and up to the anchorage off the town.

To anchor in the Bight, the above course must not be continued farther than to have Orcomb point in one with the point below Gun cliff near the coast-guard station, which may be run with until the upper coast-guard boat-house, the first building northward of the baths, comes on with the ornamental villa called the Temple, remarkable from its Grecian design. These two in one will lead clear of the Warren and the Ridge; when the low point of Orcomb is observed to be coming on with the perch on the Checkstone and the high tangent of Warren point, haul to the northward for the Bight, and anchor by the lead anywhere abreast the black buoy of the Bull-hill bank. A pool of deep water runs up from the Bight to Starcross, in which vessels may lie with 6 or 7 feet at low water.

Approaching the entrance from the westward, after rounding Clerk point and a remarkable rock outside it called the Clerk, keep Exmouth church well open of Warren point, N.E. by E., to pass eastward of the Dawlish rock. Abreast Clerk point, at half a mile off shore, the fair-way buoy bears E. by N., when it will be in line with Straight point, and distant 4 miles. Between Clerk and Langstone points, the low-water rocks dry more than a cable's length off shore with a gradually shelving bank outside them.

A good turning mark up to the fair-way buoy is, to keep the whole of the town of Exmouth open of Warren point, and not to open Mamhead tower northward of Langstone point, which precaution will avoid the Pole and shallow flat sands westward of it; but the soundings are regular, and a common attention to the lead, making due allowance for the rise or fall of tide, will always afford sufficient warning.

Entering from the eastward steer for Straight point, which may be

rounded with safety at a quarter of a mile ; then keep Mamhead tower in line with the houses at Mount Pleasant, which rises a little to the northward of Langstone point, bearing about W. by N. $\frac{1}{2}$ N. This, although a close mark, is a safe one with a fair wind for clearing the ledges between Straight and Orcomb points, and also leads well inside the fair-way buoy, and up to the fair-way mark for entering the harbour.

As the entrance of this harbour is not lighted, it cannot be run for with safety at night.

BUDLEIGH SALTERTON.—The coast from Exmouth trends eastward 15 miles to Culverhole point ; it then curves in a south-east direction 24 miles to the Bill of Portland. Between Exmouth and Culverhole point are the three watering places, Budleigh Salterton, Sidmouth, and Seaton, neither of which have any trade, but colliers in fine weather anchor abreast them, and land their cargoes on the beach.

The village of Budleigh Salterton stands about three-quarters of a mile westward of Otterton point, in a narrow dell running obliquely to the shore, and in 1861 its population amounted to 1,687. Between the village and the point is the river Otter, a small rivulet, whose mouth, which is barred by an accumulation of shingle, is about 60 feet wide at high-water springs, when there is a depth of 6 feet water. Approaching the anchorage off the village, be careful to avoid Foot Clout rock, with only 2 feet water, lying half a mile S.E. by S. of the chapel ; also Otterton ledge, which runs off a quarter of a mile S.W. $\frac{1}{4}$ W. from Otterton point.

The obelisk in Bicton park in line with the coast-guard watch-house on the shore, N.N.E. $\frac{1}{4}$ E., leads westward of the Foot Clout ; and Sidmouth church open a quarter of a point of the land east of Otterton point, leads in 3 fathoms water outside Otterton ledge ; but all the rocky ledges between Straight point and Beer head will be avoided by keeping half a mile off shore.

SIDMOUTH is $4\frac{1}{2}$ miles E.N.E. of Budleigh Salterton, in a valley running nearly at right angles to the coast, and is bounded by Salcombe hill, 535 feet high, to the eastward, and by High Peak, 500 feet high, to the westward. The Sid, a mere streamlet, flows close to the east side of the town, but its entrance is choked by the shingle beach, the water merely percolating through the bank to the sea.

BEER HEAD is a lofty and precipitous chalk cliff, 426 feet high, the westernmost in England. On the eastern side of the head is a confined anchorage sheltered from northerly winds. The best position for anchoring is with Beer head W. $\frac{3}{4}$ S., and Beer village N. by W. $\frac{3}{4}$ W., in about 5 fathoms over sandy bottom.

AXMOUTH.—Between Beer head and Haven cliff is the broad and fertile valley of the Axe, apparently the ancient bed of a large river, though

at present only an insignificant stream flows into the sea. At the entrance of the river Axe there is a small pier and landing quay; whilst under Haven cliff, which forms a prominent object from seaward, is a dock, which is said to accommodate vessels drawing 12 feet water. A short distance westward of the pier, stands the village of Seaton, which is favourably known as a pleasant watering place.

LYME REGIS HARBOUR.—At 3 miles eastward of Culverhole point and N.N.W. $\frac{3}{4}$ W., 22 miles from the Bill of Portland, is the small pier harbour of Lyme Regis, which dries at low tide, but carries a depth of from 9 to 12 feet at high water springs. The Cobb or pier, a substantial stone structure, shelters small vessels within it from south-westerly gales; whilst the inner pier and north wall protect it from the swell caused by gales from the south-eastward. The bed of the harbour being of hard marl with only a surface coating of a few inches of mud, vessels occasionally strike heavily on taking the ground, particularly when a heavy sea outside causes a run within the pier. From the Cobb end, in the same line as the Cobb, there is a sharp point of loose stones, the outer end of which is marked by a beacon.

A Life Boat is stationed at Lyme Regis.

LIGHTS.—From half flood to half ebb a *fixed red* light is shown on the inner pier head of Lyme Regis harbour, and another light, also *red*, at the custom house. They are 275 yards apart in a N.W. $\frac{1}{2}$ N. and S.E. $\frac{1}{2}$ S. direction. The light at the pier head is 11 feet, and the other light 21 feet above high water, and both may be seen in clear weather from a distance of 4 miles.

TIDES.—It is high water, full and change, at Lyme Regis at 6h. 21m.; springs rise $11\frac{1}{2}$ feet, and neaps $8\frac{1}{2}$ feet. At a mile southward of the harbour the stream makes to the eastward at 4 p.m., and to the westward at 10 a.m.; its greatest rate is only a knot, with an interval of slack water.

DIRECTIONS.—To enter the harbour at night, the high red light kept a little open eastward of the low red light, N.W. $\frac{1}{2}$ N., will clear the outer Cobb end, and lead to the inner pier heads. By day, steer for the beacon placed at the extreme end of the reef projecting from the outer pier head, and give it a berth of 20 or 30 yards in passing. In strong southerly winds the sea breaks heavily round the piers; the proper place then for a wrecked crew to take the beach would be at the back or eastern side of the north wall, where the boat would most probably be driven.

High Ground and Pollock are two rocky shoals, about three quarters of a mile apart, with 6 fathoms water between them, lying westward of Bridport harbour. The High Ground, the westernmost shoal, lies W. by N. $\frac{1}{2}$ N., $1\frac{1}{4}$ miles from Bridport pier heads, and about half a mile

off shore; it is half a mile in length, $1\frac{1}{2}$ cables broad, and has only 9 feet water near its south-east end. The Pollock is a smaller shoal, about $1\frac{1}{2}$ cables in diameter, and nearly circular; it lies W. by S., three-quarters of a mile from the pier heads, and has 11 feet over its shoalest head.

Puncknoll knoll, a conical hill 587 feet high, having a small house on its summit, in line with the low end of the east and last cliff to the eastward of Burton coast-guard houses, S.E. by E. $\frac{1}{4}$ E., leads to the southward of both the High Ground and Pollock. Down hall, a large white house, in trees, on the northern side of Bridport, on with Bridport pier head, N.E. $\frac{3}{4}$ N., leads eastward of the Pollock; the west end of North hill, 376 feet high, the first hill inland of Bridport east cliff, on with the pier head, E. $\frac{3}{4}$ S., leads between the shoals; and Thorncomb peak, 509 feet high, N.E., leads to the westward of the High Ground.

BRIDPORT HARBOUR.—This small but secure pier harbour, lying $16\frac{1}{2}$ miles N.N.W. of Portland bill, has 14 feet between the pier heads at high water springs, but the entrance dries at low tide. The piers are 50 feet apart, and form a straight canal-like entrance, in a N.E. $\frac{1}{4}$ N. direction for 700 feet, and then expand into a secure basin, 530 by 145 feet, capable of containing about 30 vessels of the tonnage that usually resort to the port. The clear space for entrance or egress is only 40 feet wide. During gales the sea breaks so heavily at the entrance, that the harbour is unapproachable, and small vessels must then seek shelter in Lyme Regis.

The waters of the Brid are confined by sluice-gates at the upper part of the harbour, until near the time of low tide, when they form a sufficient scour to keep the entrance open. There is one building yard, but only a few houses and stores at the harbour. The town of Bridport is $1\frac{1}{2}$ miles inland, and in 1861 its population was 7,719; the principal manufactures are twine, lines, and fishing-nets, for the home and colonial fisheries, and sail-cloth. In 1866 there belonged to the port 10 vessels representing 1,692 tons.

A buoy is moored W. by S. $\frac{3}{4}$ S., $1\frac{1}{2}$ cables from the pier heads, to assist vessels in warping in or out of the harbour. The usual course pursued in entering, is to shoot between the piers, and be tracked into the harbour by men always in attendance at tide time. The best anchorage outside is abreast the piers, about a quarter of a mile off shore, in 3 or 4 fathoms water, over fine sand; farther off the ground is foul.

TIDES.—At the entrance of Bridport it is high water, full and change, at 6h. 5m.; springs rise $11\frac{1}{4}$ feet, and neaps $7\frac{3}{4}$ feet.

WEST BAY, the deep bight on the north-west side of Portland, is sheltered from winds between S.S.E. and N. by E., and is therefore frequently resorted to by coasters waiting tide to get round the Bill; but the

water is deep, and it cannot be recommended as a safe anchorage for large vessels; for should the wind suddenly change to the westward, a heavy sea soon gets up, and the holding ground is bad, being loose gravel or shingle.

There is anchorage in any part of the bay. Small vessels anchor off the south end of Chesilton village, a third of a mile off shore, in 8 or 9 fathoms, over clay bottom, with Portland high lighthouse touching Blacknor point, S.S.W. $\frac{1}{4}$ W. Good shelter will be found about $1\frac{1}{4}$ miles off shore, in 17 fathoms, coarse gravel and shells, the Bill bearing South, and the abrupt shoulder of the Vern about E. $\frac{1}{2}$ S.

TIDES.—At Chesilton, in West bay, it is high water, full and change, at 6h. 13m.; springs rise $10\frac{1}{4}$ feet, and neaps 7 feet. In the middle of the bay, the stream makes to the south-eastward at 1h. 40m., and to the north-westward at 10h. 46m., thus setting towards the Bill nine hours out of twelve, with a velocity of 2 knots, which rate is rapidly increased as the Bill is approached. The duration of the northerly set does not exceed a couple of hours, and runs with scarcely any appreciable force.

DIRECTIONS.—Great caution is necessary, if at anchor in West bay, to guard against a sudden shift of wind to the westward and south-westward, for such winds send in a heavy sea, against which few anchors would hold, or few vessels could attempt to beat with any prospect of success; for although the tide sweeps strongly along the cliffs to the southward, its influence is too closely confined to the shore to produce any advantageous effect on vessels striving to gain an offing. A vessel, however, may, between the periods of half-flood and half-ebb, work out of the anchorage with the wind to the southward of S.S.W.; and the attempt might succeed from half-ebb to half-flood, provided the wind was to the northward of W.N.W.; but no reliance should be placed on this alternative, as a vessel on all occasions would be much safer at sea.

Although there is no sensible indraught into West bay, a vessel embayed in a S.W. gale should endeavour to keep off-shore until the eastern stream makes, then with the assistance of the tide endeavour to round the Bill, and passing within the Shambles make for Portland harbour of refuge. If the western stream is running, and she cannot be kept off shore, attempt Bridport harbour, and if this harbour cannot be entered, beach the vessel close to the eastern side of its piers.

BILL OF PORTLAND, bearing E. $\frac{1}{4}$ S. 48 miles from the Start, is the south extreme of Portland peninsula, which is $3\frac{1}{2}$ miles long. N.E. and S.W., and $1\frac{1}{2}$ miles wide at its broadest part, near the centre. The peninsula is connected with the adjacent coast by a narrow isthmus of coarse shingle, the eastern end of a remarkable raised beach known as Chesil bank. The isthmus is 40 to 45 feet above low water, and 650

feet across from West bay to Portland road. The Vern, near the north end of the peninsula, is elevated 488 feet above high water, and thence the land slopes gradually to the south-west, terminating in the Bill, 40 feet high; the whole presenting a remarkable wedge-like appearance, invaluable to seamen, as a point of recognition in sailing up or down Channel.*

Portland is one immense block of freestone, and its valuable quarries are extensively worked. Near the centre is St. Georges church, the top of which is 390 feet above high water, and with the two windmills near it are useful seamarks. The two white lighthouses which stand about half a mile within or N.N.E. of the Bill, are also conspicuous objects. On the extreme point of the Bill, a stone beacon 20 feet high, with its summit 60 feet above high water, is placed as a guide for small vessels. to guard them against a low shelf of high water rock, the top of which has been quarried away for nearly 100 feet; large loose stones and masses of rock extend at least 150 feet beyond the point.

LIGHTS.—The two lighthouses near the south end of Portland are 50 and 85 feet in height, and 503 yards apart. They each exhibit a *fixed* white light, and when in one bearing N.N.W. $\frac{3}{4}$ W. lead between the Race and Shambles. The high light is 210 feet, and the low light 136 feet above high water level, and in clear weather they should be seen from the respective distances of 21 and 18 miles. The low light is only visible seaward when bearing between E.S.E. and W. by S.; on all other bearings it is hidden by the high land.

Portland Ledge.—Portland is safe to approach on all sides, but the soundings are irregular, particularly near the Bill, where a remarkable shelf of rock, called Portland ledge, extends a mile in a S.S.W. direction from the pitch of the Bill, terminating in a sharp point. The inner part of the ledge is nearly a mile across, and continues to flank the shore to the south-east for about $1\frac{1}{2}$ miles.

The soundings over the ledge vary from 3 to 9 fathoms, breaking down suddenly into deep water, on the west side into 20 fathoms, on the south into 18, and on the east side into 13 and 14 fathoms.

At a quarter of a mile from the Bill of Portland there is a depth of 5 fathoms; at a mile distant 10 fathoms; and $1\frac{3}{4}$ miles off 20 fathoms.

RACE OF PORTLAND.—The tide runs with great violence round the Bill and over the ledge, causing fearful whirls and eddies in its progress;

* See Admiralty Charts: Weymouth and Portland Roads, No. 2,255, scale, $m = 4$ inches; England, South Coast, Sheet 4, No. 2,450, scale, $m = 0.5$ inch; and Portland to St. Albans Head, No. 2,615, scale, $m =$ one inch.

but there is generally an eddy of still water, a quarter of a mile wide, between the Race and the land.

In northerly winds, the Race extends from the Bill nearly 2 miles, and there are great overfalls even beyond that distance; but with southerly winds, it scarcely exceeds half a mile. During the north-eastern stream of tide, the overfall takes place to the eastward, and during the south-western stream to the westward.

During spring tides, which run at the rate of 5 or 6 knots, the agitation is so violent as to render it dangerous for small vessels to pass through the Race; and in tempestuous weather, during the north-eastern stream, the whole space between Portland and the Shambles is one sheet of broken water. The turbulent sea thus created has, in some instances, so alarmed strangers, as to induce them to bear up and run their vessels on shore on Chesil beach; a fatal error, leading in the majority of cases to the loss of ship and crew. In fine weather even, the noise caused by the Race may be heard a considerable distance.

The **SHAMBLES** is a dangerous bank of coarse sand, gravel, and broken shells, the western end of which,—assuming the depth of 10 fathoms for its limits,—bears from the Bill of Portland S.E. $\frac{1}{2}$ E. $2\frac{1}{4}$ miles; and thence its direction is E. $\frac{1}{2}$ S. $2\frac{1}{2}$ miles, with an average width of two-thirds of a mile. The depths on this bank are irregular, as there are several shoal heads with only from 11 to 18 feet on them, and 5 to 7 fathoms between. The least water, 11 feet, is near the middle of the shoal, from which St. Georges church is in line with the south side of Church cove, N.N.W. $\frac{1}{4}$ W.

The position of the Shambles is clearly shown, except at slack water, by a ripple or overfall on the north or on the south side according as it may be flood or ebb. On the south side the bank rises suddenly from the depth of 10 fathoms into shallow and numerous heads with 5 to 2 fathoms water over them. The approach on the north side is more gradual; but as there are occasional shoal patches, it would not be safe for a vessel of large draught to stand into less than 10 fathoms. The bank should on no account be crossed by vessels drawing more than 10 feet, and then only in fine weather. Blowing hard, the sea breaks furiously over it, and instances are known of small vessels foundering on it.

Wyke Regis church open of the low north-east point of Portland, N.N.W. $\frac{1}{4}$ W., clears the east end of the Shambles; and St. Georges church open a quarter of a point westward of Portland windmills, N. $\frac{1}{4}$ W., leads over the west end in 8 fathoms; and the small chalk pit—seen to the westward of a large figure of a man on horseback cut out of the chalk on Osmington down, see page 125,—in line with the east point of Portland, N.N.E., will lead westward of the west end of the shoal, and between it and the Race.

Anvil point seen just clear of St. Albans head, E. $\frac{3}{4}$ S., will lead a quarter of a mile northward of the Shambles; and the point open 3° of the head, bearing East, three-quarters of a mile to the southward. As Portland lights afford no guide at night for sailing outside this shoal, no vessel should approach it within the depth of 20 fathoms. The tide at full and change sets over the shoal from 3 to 4 knots in an E. by N., and W. by S. direction, making to the eastward at 3h. 15m., and to the westward at 10h. 45m.

The SHAMBLES LIGHT-VESSEL, moored off the east end of the shoal in $14\frac{1}{2}$ fathoms at low water, exhibits at 38 feet above the sea a *fixed* white light, visible in clear weather from a distance of 10 miles. The vessel has one mast, with ball on summit, is painted red, with the word Shambles on her sides. A gong is sounded in foggy weather, and a gun fired if a ship is seen standing into danger. From the vessel, Belfield house (in the trees) to the westward of Weymouth, between the piers of Portland breakwater, N.N.W. $\frac{1}{8}$ W.; the southern windmill at Portland in line with the eastern point of Church cove, N.W. $\frac{1}{8}$ W.; and Portland low lighthouse N.W. by W. $\frac{3}{4}$ W.

DIRECTIONS.—The channel between the Bill of Portland and the Shambles should never be attempted by a sailing vessel without a commanding breeze. The leading mark between the Race and the shoal is, the small chalk-pit—to the westward of the white horse on Osmington down—in line with Grove (the eastern) point of Portland bearing N.N.E.; but as the chalk-pit is a distant object, and not always sufficiently distinct to be identified, an equally good mark is the north end of Portland breakwater just open of Grove point, on the same line of bearing. In coming from the westward, keep in shore immediately Portland ledge is passed, as the eastern stream sets direct from the Bill for the Shambles.

Vessels bound to the westward with a westerly wind, may, while the eastern stream is running, turn to windward nearly up to the Bill by keeping near the eastern shore of Portland; but in all probability if they attempt to round the Bill before the tide slacks they will be swept off shore and carried through the Race. Coasters can approach this shore to a cable's length in not less than 3 fathoms water; vessels of large draught should not approach nearer than a quarter of a mile.

Between the Race and the Bill there is a useful channel, with from 3 to 9 fathoms water, which is frequently used by small vessels, particularly with a leading wind. If intending to run through from West bay, weigh with the last of the ebb, and steer for the high lighthouse, keeping the Bill rather open on the starboard bow, with which precaution, as the vessel nears the shore, the tide will sweep her round the point and

within the Race ; but to shape a course for the Bill, in order to give it a berth, she would be caught in the strong tide. With a beating wind, work close up along the land, as it is bold to a cable's length.

Although this passage is frequently used by small vessels, it should be borne in mind that there is a strong eddy tide or 9 hours set on the eastern side of Portland, running in a different direction to the one out of West bay. If, therefore, the vessel is so late in the tide as not to be able to get round Grove point before the fourth hour of flood, she had better anchor, to prevent being carried back again into the West bay tide, or endeavour to get off shore to the eastward into the fair flood stream.

At Night the leading mark between the Shambles and the Bill is the two lights in one, N.N.W. $\frac{3}{4}$ W., until the fixed red light on the breakwater bears N. by E. $\frac{3}{4}$ E., when steer for it, taking care to keep a safe offing on approaching Grove point, and a prudent distance when passing the breakwater. During the eastern stream the higher light should be kept open to the westward of the lower one, as that stream sets with great velocity over the Shambles; and as the western stream sets as strongly into the Race, similar precautionary measures should be taken not to be set to the westward.

PORTLAND REFUGE HARBOUR.—At $5\frac{1}{2}$ miles E. by N. $\frac{1}{2}$ N. from the north-east end of Portland is Whitenore point, and between are Portland and Weymouth roads, separated from each other by the projecting point of the Nothe, which forms the south side of Weymouth harbour.

Portland road has always afforded safe shelter except from winds between South and East ; and to guard against these a breakwater, projecting in a north-easterly direction from the north-east end of Portland, was commenced in 1849, and now offers a secure Refuge harbour easy of access by night or day. The breakwater runs out 2,000 feet in an easterly direction from the north-east end of Portland, to an opening 400 feet wide ; and thence it curves round and takes a N.N.E. $\frac{1}{2}$ E. direction for 7,000 feet to its north-east extreme, enclosing an area of about 4,310 acres, varying in depth from 3 to 9 fathoms.

The area included in the harbour without the 5-fathom line, is 1,430 acres, in the whole of which the largest ships may anchor, over clay bottom, sheltered from all winds ; but during southerly gales the wind frequently flies suddenly round to the N.W., blowing in heavy gusts over Chesil bank, and causing a short unpleasant sea dangerous for boats. Vessels may ride with great safety at single anchor, as there is no tide except near the opening of the breakwater. If obliged to moor, have the hawse open to the northward, with the small bower to the prevailing

westerly winds, a good scope of cable out and—in winter—sheet anchor ready.*

At $1\frac{1}{2}$ miles from the north end of Portland a timber bridge connects Chesil bank with the coast, at the entrance of a remarkable salt water lake, called the Fleet water, which runs at the back of the shingle beach as far as Abbotsbury. From the Fleet the shore gradually rises to the Nothe, which is 75 feet high. On a projecting point between the bridge and the Nothe is Sandsfoot castle, whence the shore is fringed by low-water rocks, all of which will be avoided by keeping the coast-guard houses at Preston open of Nothe point.

LIGHT.—On the outer ring of the Fort, at the north-east extremity of the breakwater, and 30 feet above high water, is exhibited a *fixed red* light, which should be visible in clear weather from a distance of 9 miles. Vessels should keep a cable's length from the light.

TIDES.—At the Bill of Portland it is high water, full and change, at 6h. 35m., and low water at 12h.; springs rise 9 feet, and neaps $6\frac{1}{2}$ feet. At Portland breakwater at 7h. 1m.; springs rise $6\frac{3}{4}$ feet, and neaps $4\frac{1}{2}$ feet.

DIRECTIONS.—With the Shambles light-vessel or light in sight, there is no difficulty in approaching Portland harbour by night or day. It will, however, be requisite during the western stream, especially in light winds, to give the east end of the Shambles a wide berth by keeping Wyke Regis church well open of the north-east end of Portland, to ensure not being swept over that shoal, which has in many cases proved fatal. After passing this danger steer for the Breakwater light on a N. by W. $\frac{1}{2}$ W. bearing, and giving it a berth of not less than a cable's length in rounding, anchor as convenient, according to the vessel's draught.

Merchant vessels should anchor westward of the line between two whitewashed marks near the Harbour Master's office and the Nothe.

WEYMOUTH ROAD and HARBOUR.—Weymouth road, between the Nothe and Redcliff point, is free from foul ground and open only to winds between South and East. It is frequently resorted to in the summer and fine weather. The usual anchorage is about a mile off the town, in from 5 to 8 fathoms water, over sand and gravel. Vessels should not anchor within three-quarters of a mile of the northern shore of the road as the ground there is foul.

* Captain J. J. Ball, R.N., late Harbour Master, Portland, suggested that vessel, wintering in the harbour should have their sheet anchors a cock-bill, and at the cat-heads instead of letting go from the waist.

The little river Wey divides the towns of Weymouth and Melcombe Regis, and falls into Weymouth road on the Northern side of Nothe point, from which a stone pier runs out E.N.E. 280 feet, and is continued 370 feet farther by a breakwater of loose stones which cover at high water ; its outer end is marked by a buoy. The north side of the entrance is protected by a stone pier, running out E. by S. from the south end of the esplanade of Melcombe Regis, and from its outer end a pile pier extends 300 feet. The harbour carries 7 feet at low water, and 14 feet at high water springs. A swing bridge connects the towns of Weymouth and Melcombe Regis, above which is a large pool, called the Back water, where yachts and small craft are laid up during the winter.

Weymouth, originally a small fishing town, has, from its excellent beach and roadstead, become a place of some importance, and is resorted to during the summer season by numerous visitors for the benefit of sea bathing. In 1861 its joint population with Melcombe Regis was 11,383. In January 1866, there belonged to the port 67 sailing vessels, representing 5,426 tons, and 10 small steamers ; and there are two patent slips for repairs, and two building yards. There is a tank for the use of shipping on the north quay, and vessels are supplied with water at the charge of 4s. per ton.

LIGHTS.—Near the beach to the eastward of the Railway station are two *fixed red* lights, 30 feet and 20 feet above high water, and bearing from each other N.N.W. and S.S.E. On the north pier of Weymouth harbour are two *fixed green* lights, 20 feet high, bearing E. $\frac{3}{4}$ N., and W. $\frac{3}{4}$ S. of each other.

DIRECTIONS.—Approaching Weymouth harbour, keep St. Johns church at the north end of Melcombe Regis—open eastward of the pile beacon, bearing N. $\frac{3}{4}$ W. to clear the Mixen rocks, which run off nearly a cable's length eastward from Nothe point ; these, and the rocks extending about 180 feet from the north-east point of the Nothe to the beacon, are the only dangers to avoid in entering the harbour. Give the buoy a berth of about 200 feet in rounding, on its eastern side, and keep in mid-channel until the vessel is abreast the outer south quay. She will then be within the northern jetty and past the rocks running out from the Nothe, after which the deepest water is on the south side of the harbour.

At night, after passing the Portland breakwater light, bring the two red lights at Weymouth in line N.N.W. and keep them on, until the two green lights on Weymouth north pier are in line, W. $\frac{3}{4}$ S. ; this latter mark leads in through the deepest water until close to the north pier lights, which may be passed close to, and thence a mid-channel course up the harbour should be preserved.

The COAST from Weymouth curves round to the north-east, and is low and flat to the north shore of Weymouth road. Jordan hill, in the northern part of the road, rises with an even slope to about 160 feet, and eastward of the hill commences a series of low cliffs intersected with steep ravines; Redcliff point, the westernmost of these cliffs, is 150 feet high. The cliffs gradually increase in height to Whitenore point—chalk over green sand—where they are 542 feet above high water. The land rises from the cliffs to the downs, and on Osmington down, $1\frac{1}{2}$ miles from Redcliff point, is the large figure of a man on horseback cut out of the chalk, showing white on the green slope of the hill, and visible for many miles seaward.

Between Weymouth road and St. Albans head the shore is chiefly of chalky cliff; from the latter to Peverel point dark rock, and thence again chalky as far as Old Harry, where it abruptly declines.

Ringsted Ledges.—There are several rocky ledges bordering the coast on the north side of Weymouth bay. Those off Ringsted point are low flat ledges of indurated clay, extending a third of a mile from the shore, with only 10 feet water over their outer end. Lodmoor farm just open of the base of the cliff at Preston coast-guard houses, N.W. $\frac{1}{2}$ W., leads south of all the foul ground from Redcliff point to Whitenore point. Between the latter and Warbarrow head the shore is generally bold, but there are a few outlying rocks, which will be avoided by keeping Swyre Barrow hill, 674 feet high, open of Broad bench point, S.E. by E. $\frac{1}{2}$ E.

LULWORTH COVE, 3 miles eastward of Whitenore point, is a circular little basin begirt by high cliffs of chalk and sand, and in cases of necessity would afford shelter to small vessels. The clear entrance to it is about 250 feet wide, between ledges of low-water rocks running off from each point; the longest ledge being on the western side. In entering keep one third over from the eastern cliff. Within the cove there are 12 feet at low water springs, which rise 7 feet, and neaps $4\frac{1}{2}$ feet.

WARBARROW BAY is a mile eastward of Lulworth cove, and shelters from winds between W. by N., round northerly, and S.E. by E. It is about $1\frac{1}{2}$ miles wide, and half a mile deep, and compassed by high cliffs being cleft in the centre by Arish Mill gap. The best anchorage is between this gap and Warbarrow head, a third of a mile off shore, in 5 to 7 fathoms water, over fine sand.

Water.—There is a stream of fresh water and good facilities for watering in the small boat harbour at Osmington mills, a short distance westward of Ringsted point; the west point of entrance is marked by a beacon. Water can also be obtained at Lulworth, Arish Mill gap, and in Wor cove.

Kimeridge Ledges.—From Warbarrow head to St. Albans head the coast consists of a succession of dark-looking cliffs, fringed by long flat

ledges of indurated clay, some of which extend half a mile off shore. Arish Mill gap, open of Warbarrow head, bearing N.W. by N., leads outside them. Arish Mill gap will be known by its white sandy beach; Warbarrow head by the small conical hill on its summit.

Between Warbarrow and St. Albans heads are two coves named Kimeridge bay and Chapmans pool, but neither affords safe anchorage.

ST. ALBAN'S HEAD, from which the Bill of Portland bears W. $\frac{3}{4}$ N. $15\frac{1}{4}$ miles, and St. Catherine point, E.S.E. $28\frac{1}{2}$ miles, is a bold headland 359 feet high, on the summit of which is an ancient chapel or chantry. It has generally a race running off it, particularly in blowing weather, caused by the unevenness of the ground. The overfalls extend about a mile off shore, and are sometimes found more westerly, and sometimes more easterly, according as the wind and tide act in concert with or against each other. There are not less than $5\frac{1}{2}$ fathoms water in their vicinity, with 12 and 15 fathoms on both sides, as well as to the southward.

PEVEREL POINT.—Between St. Albans and Durlston heads is a clear bold shore of dark-looking limestone cliffs, the quarries of which are extensively worked. At Durlston head the coast bends abruptly to the northward, forming the western shore of the deep inlet between St. Albans head and St. Catherine point.

Several rocks lie between Durlston head and Peverel point, and vessels passing should not bring the head to the southward of S.W. by W. $\frac{1}{2}$ W., nor approach the point within a third of a mile, until Swanage church comes well open of the northern shore of Peverel point, W.N.W. Old Harry, a pinnacle rock off Standfast point, in line with Poole head watch-house, which stands in the north-west angle of Poole bay, N. by E. $\frac{3}{4}$ E., leads three-quarters of a mile outside Peverel ledge, which extends some distance off Peverel point, and over which a tide race runs with considerable strength.

SWANAGE BAY is close round Peverel point, but the anchorage in it is not much used except by small vessels in fine weather. They anchor on the south side of the bay in 4 to 6 fathoms, over fine sand, half or three quarters of a mile off shore. A pier 273 yards long and 18 feet wide runs out in an easterly direction, and has on it two 5-ton cranes, with which vessels lying alongside are loaded with Purbeck stone, which is shipped in large quantities. At the end of the pier there is a depth of 18 feet water at high water springs. The population of the town of Swanage in 1861 was 2,004.

The shores of the bay rise with a gradual slope from the sea, and at the north point is the east end of the chalk range that extends across the country

from Whitenore to Ballard down, where it terminates in white cliffs, which re-appear again at the Needles.

A Life Boat is stationed at the island of Purbeck.

TIDES.—At Swanage the first high water, at full and change, is at 8h. 20m., the second rise at 12h. 20m., and at low water at 3h. 20m.; springs rise $6\frac{1}{2}$ feet, and neaps $4\frac{1}{2}$ feet (*see* page 136).

STUDLAND BAY.—Ballard and Standfast points separate Swanage and Studland bays, and in rounding them do not approach the shore nearer than a quarter of a mile. Off Standfast point are two remarkable pinnacle chalk rocks, called Old Harry and Old Harry's Wife.

Studland bay, on the north side of Standfast point, affords good shelter for small vessels during westerly winds. The best anchorage is off three remarkable projections in the chalk cliff, called the Yards, in about 2 fathoms water, with the Agglestone—a large square rock on a small hill half a mile inland—open northward of the coast-guard buildings on Red-end point, W. by N. $\frac{3}{4}$ N., and Shepherds hut S.S.W. Large vessels anchor farther out according to their draught, with Studland church bearing West.*

POOLE HARBOUR.—From Studland to Poole head is a range of hillocks of drift sand, and between them is the entrance to Poole harbour, only $1\frac{1}{2}$ cables wide between the Haven points, and the navigable channel not more than half that distance across. The harbour is a capacious estuary resembling at high water an inland lake, which branches in every direction into the heaths surrounding it. Its navigable channels being narrow and intricate, and its entrance fronted by shifting sands, it should not be attempted without a pilot.

The town of Poole, standing on the north shore of the harbour, 3 miles within the entrance, is an intricate cluster of houses, pierced by a High street a mile in length, and terminated towards the harbour by capacious quays. There is no dock, gridiron, nor patent slip; and vessels requiring to be hove keel out, are hauled down to large fixed careening blocks. Poole has a considerable foreign trade, and in 1866, there belonged to the port 100 sailing vessels, representing 9,556 tons, and two small steamers. The chief articles of export are, manufactured goods, corn, flour, biscuit, iron, salt, clay, sanitary pipes, stone, nets, cordage, leather, &c., and Purbeck clay. The imports are, corn, timber, iron, hemp, flax, pitch, tar, oil, salt, fish, skins, wine, spirits, &c. The population in 1861 was 9,609.

Wareham stands 5 miles above Poole, between the rivers Trent and Frome, which unite at one mile below the town. The channel through the

* *See* Admiralty Chart of Poole Harbour, No. 2,175; scale, $m = 4$ inches.

Frome, or south river, is navigable to Wareham quay for vessels of 20 or 30 tons.

LIGHTS.—On the south part of North Haven point, at the entrance to the harbour, are two *fixed* white lights on lamp posts, bearing N. $\frac{1}{3}$ W. and S. $\frac{1}{3}$ E. from each other, distant 262 yards apart. The northernmost or high light is 37 feet, and the low light 16 feet above high water, and both are visible in clear weather from a distance of 6 miles. The low light is masked between the bearing of N. by E. $\frac{1}{4}$ E. and N. $\frac{1}{2}$ E.

There are four more *fixed* lights within the entrance ; viz., a white light on North Haven point, a white light near Lilliput farm, and two *red* lights at the town.

A *Life Boat* is stationed at Poole.

TIDES.—Owing to the double high water (*see* page 136) in Poole harbour, the tide stands at a high level for about $3\frac{1}{2}$ hours. At Brownsea island, on full and change days the first high water is at 8h. 50m., the second rise at 12h. 25m., and low water at 3h. 50m.; springs rise $6\frac{1}{2}$ feet, neaps $4\frac{1}{2}$ feet, but both very uncertain. At Poole quay the first high water is 20 minutes later than at Brownsea; but the second rise and low water are simultaneous at both places; and the rise and fall are also the same.

At Russell quay, half way between Poole and Wareham, the first high water is 40 minutes after that of Brownsea, but the second rise and low water are 20 minutes later; rise and fall the same. At Wareham quay, the first high water is 1h. 25m., the second rise 1h. 15m., and low water 1h. 25m. later than at Brownsea; rise at springs 4 feet. From the great extent of mudlands over which the tide flows, and the number of streams that fall into Poole harbour, the tide rushes with great force through the narrow opening at the Haven points, and has there scoured out a channel, with from 6 to 8 fathoms in it at low water.

DIRECTIONS.—The approach to Poole harbour, between the banks fronting its entrance, is narrow and intricate, and though great attention is constantly paid to buoying and lighting the channel, yet it is only a case of necessity that can justify a stranger in attempting to enter without a pilot, who is always in attendance in Studland bay.

The best and indeed the only buoyed channel into Poole harbour is that known as the Swatchway, which has lately been increased in width and depth by the extension of a breakwater from the shore in the vicinity of South Haven point, in order to arrest the ebb current in its passage to the sands and flats of Studland bay, and direct its course so as to scour this channel.

The least known depth in the Swatchway is $6\frac{1}{2}$ feet, and as the rise at springs is $6\frac{1}{2}$ feet, the depth at high-water springs will be 13 feet.

The starboard side of the channel on entering is marked by black can

buoys, and the port side by cask buoys striped red and white vertically; the third buoy on the port side, being distinguished by a staff and ball. The lighthouses on North Haven point in line N. $\frac{1}{2}$ W., leads through the Swatchway.

From Brownsea castle the channel is clearly pointed out by buoys striped red and white vertically, to be left on the port hand, and perches on the mudbank on the starboard hand. The Middle ground has a ball beacon on its southern end, which must be left to port, and a red buoy on its upper end; from thence the channel is marked by perches on each side to Poole creek, which has a black buoy on the starboard side of entrance, and a beacon on the port side.

The main channel above Poole to Wareham is marked by perches on each side, and buoys at the first curve; the buoys striped red and white vertically to be left to port, and the black to starboard. Besides the main channel, the harbour contains a number of creeks, inlets, bays, and islands, for which see chart.

At Night, if compelled to take the harbour, the lights in line N. $\frac{1}{2}$ W., will lead through the Swatch and up the channel to the Haven points; after which keep in mid-channel, and anchor off Brownsea castle.

POOLE BAY.—At Poole head the coast curves to the eastward, and thence to Hurst point are a succession of earthy cliffs intersected with deep ravines, called chines, worn away by the action of small streams. From the soft yielding nature of the shore, the action of numerous springs, and the violence of the waves, the sea is encroaching on the whole of this part of the coast, evidenced by frequent landslips, and the fall of enclosures, fields, roads, and houses over the cliff.

In the southern part of Poole bay the ground is clear, and there is an open anchorage in from 6 to 7 fathoms water, over sand and gravel, with Studland church bearing West $1\frac{1}{2}$ miles. In the northern part of the bay, however, are several patches of dangerous rocks, with 6 and 7 fathoms between them. The shoalest head of only 8 feet water, named Inner Poole patch or Woodbury rock, lies half a mile off Poole head; and another, the Outer Poole patch, with 16 feet on it, nearly $1\frac{1}{2}$ miles from the Bournemouth shore. Arne trees—a remarkable clump on a hill 178 feet high, near the head of Poole harbour—on with North Haven point and well open south of Brownsea island, N.W. by W., leads southward of these dangers; and the whole of Swanage well open of Ballard point, S.W. by W. $\frac{1}{2}$ W., leads eastward.

BOURNEMOUTH, built on the sides of a steep and thickly wooded chine, 2 miles eastward of Poole head, is a watering place of recent creation, and consists of an irregular cluster of villas scattered through a

valley. A pier, 16 feet wide, and with a T head, runs off 267 yards from the shore. The head is 36 yards long, 30 feet wide, and there are 14 feet alongside it at high water springs.

To the westward of Bournemouth the ground is foul, and nearly half a mile off shore are Bournemouth rocks, with 14 feet, and within them is Darby rock with 8 feet water. Brownsea castle kept open of the base of Poole head, W. $\frac{1}{2}$ N., leads southward of this foul ground, and Durlston head open of Old Harry S.W. $\frac{1}{4}$ W. leads eastward. Between Bournemouth and Christchurch ledge there are no outlying dangers, and the shore may be approached to a third of a mile.

Christchurch Ledge.—Christchurch or Hengistbury head, 120 feet above high water, is 6 miles eastward of Poole head. It is composed of dark reddish-looking ironstone, and being of harder material than the coast to the westward, gives way more slowly to the action of the numerous springs and the violence of the waves; but even here it was shown, by actual survey, that 300 feet had gone from the point of the head between 1847 and 1854; this distance has since been considerably increased by large quantities of ironstone having been taken from the face of the cliff.

A narrow rocky ledge runs $2\frac{3}{4}$ miles in a S.S.E. $\frac{3}{4}$ E. direction from Christchurch head, and near the middle, at $1\frac{1}{4}$ miles from the head, a black buoy is moored in 3 fathoms water; but it must be remembered that there are only $2\frac{3}{4}$ fathoms on the end of the ledge at twice that distance from the shore. The tower of the Priory church at Christchurch, just open eastward of the coastguard watch-house on Christchurch head, N. by W. $\frac{1}{4}$ W., leads along the west side of the outer part of the ledge, and may be used until a vessel is half a mile from the shore; and Noddes beacon, on the Isle of Wight, in line with the junction of the red and white cliffs in Alum bay, E. by S. $\frac{3}{4}$ S., leads southward of the ledge and of the Dolphin bank, up to the fair-way of the Needles channel.

CHRISTCHURCH HARBOUR.—At the distance of three-quarters of a mile N.N.E. from Christchurch head is the entrance to this shoal harbour, which is only accessible to vessels of light draught, as the bar across its entrance, formed of drift sand, often dries at the lowest tides. The bar is only 6 feet over it at high water springs, and, as it often changes its position, a stranger should not attempt to cross it without a pilot.

The town of Christchurch stands $1\frac{1}{2}$ miles within the entrance, a little above the junction of the rivers Avon and Stour, and in 1861 the population of the parish amounted to 7,040. The tall tower of Priory church, 131 feet above high water, is a conspicuous object from seaward. There is a salmon fishery in the harbour, and a small amount of coasting trade is carried on in vessels of light draught.

DIRECTIONS.—As none but vessels of light draught can require to round the eastern end of Christchurch ledge in order to reach Christchurch bay, they may either pass close to the buoy in $2\frac{1}{2}$ fathoms, at low water, or attend to the following marks :—A clump of trees on a distant hill open west of High cliff trees, N. by E. $\frac{1}{2}$ E., (view B,) or High cliff house N.N.E. $\frac{1}{2}$ E. crosses the ledge in $2\frac{1}{2}$ fathoms ; and High cliff house N. $\frac{1}{2}$ E. leads over the tail of the Dolphin bank in $4\frac{1}{2}$ fathoms, and eastward of the ledge in 6 fathoms, to the anchorage off Christchurch harbour in about 3 fathoms, sand and mud, with Priory church in line with the Haven house, and Durlston head open of Christchurch head.

TIDES.—At Christchurch the first high water (*see* page 136), full and change, occurs at 9h. 0m., the second rise at 11h. 30m., and low water at 3h.; springs rise 3 feet at the town, 5 feet at the entrance points, and 7 feet outside the bar.

After the first high water, the tide falls nearly $1\frac{1}{2}$ feet, and then rises again about nine inches. From the entrance points to the bar both tides run with great velocity. Between the last quarter ebb and the first quarter flood, the water is fresh within the points.

TIDAL STREAMS.—At the Start it is high water by the shore on full and change days at 5h. 41m.; springs rise 15 feet, neaps $11\frac{1}{2}$ feet. At the Bill of Portland at 6h. 35m.; the rise 9 feet, and $6\frac{1}{2}$ feet. At the Needles at 9h. 46m.; the rise $7\frac{1}{2}$ feet, and 5 feet. The velocity of the stream off the Start is 3 knots, but when blowing fresh there is a strong race both on the flood and ebb, extending three-quarters of a mile off shore; at the north end of the Skerries and Downend point it runs $2\frac{1}{2}$ knots, off Berry head 2 knots. In Start bay the tides are weak and irregular, their general direction, nine hours out of the twelve, being to the southward, close to the shore.

Between Dartmouth and Berry head the stream turns in-shore an hour earlier than in the offing.

Off Exmouth bar, at three-quarters of a mile south of Straight point, at full and change, the stream turns to the eastward at 3h. 40m., and to the westward at 11h. 0m., running in the latter direction about $4\frac{3}{4}$ hours. The western stream for the first 2 hours runs W.S.W.; for the next 2 hours West, and it then turns gradually to the northward. The direction of the eastern stream for the first quarter is E.N.E.; at half tide, E. by N.; and the greatest velocity of both streams is about a knot.

Three miles south of Beer head, the stream turns to the westward at 10h. 30m., and runs in that direction 4 hours, then gradually turns to the northward, and runs for 2 hours between W.N.W. and N.E. by N. It may be said to turn to the eastward about 5 o'clock, and for $2\frac{1}{2}$ hours, or

until half tide, sets from N.E. to E. by N., and for the next 3 hours gradually turns to the southward. The direction of the stream in this position is, therefore, round the compass, with little or no velocity, as even at springs it scarcely runs a knot, and that only for a short period.

Two miles N.N.W. of the Bill of Portland, at full and change, the tide begins to turn at 6h. 35m., and sets as follows:—1st hour of the ebb by the shore at Portland breakwater, S. $\frac{1}{2}$ E., $1\frac{3}{4}$ knots; 2d hour, S. $\frac{1}{2}$ W., $1\frac{3}{4}$ knots; 3d hour, S. by W. $\frac{1}{2}$ W., $1\frac{1}{2}$ knots; 4th hour, S.W. by S., three-quarters of a knot; 5th hour, N.W. $\frac{3}{4}$ N., weak; 6th hour, from N.N.W. to N. $\frac{1}{2}$ W., three-quarters of a knot; 7th hour, N.N.E. to E. by N., one knot; 8th hour, S.E. $\frac{1}{4}$ E., $1\frac{1}{4}$ knots. 1st hour of the flood, S.E. by S., $1\frac{1}{2}$ knots; 2d, 3d, 4th, and 5th hours, S.S.E., 2 knots.

Near the west end of the Shambles, the 1st hour of the flood by the shore sets West, from half to $1\frac{1}{4}$ knots; 2d hour, E. $\frac{1}{2}$ N., half a knot; 3d hour, E. by N., $2\frac{3}{4}$ knots; 4th hour, E. by N. $\frac{1}{4}$ N., $3\frac{3}{4}$ knots; 5th hour, East, $3\frac{3}{4}$ knots. At the 1st hour of the ebb, E. by S. $3\frac{1}{2}$ knots; 2d hour, E. by S. to S.E. by S., $2\frac{1}{2}$ to $1\frac{1}{2}$ knots; 3d hour, South, one knot; 4th hour, S.W. by S., $1\frac{1}{2}$ knots; 5th hour, W. by S. $\frac{1}{2}$ S., $1\frac{1}{2}$ knots; 6th hour, W. by S., 2 knots; 7th hour, W. by S., $2\frac{1}{4}$ knots; 8th hour, W. by S. $\frac{1}{4}$ S., $1\frac{3}{4}$ knots.

About a mile south of the Bill of Portland, at half flood by the shore, the tide sets from S.S.E. to S.E. $\frac{1}{2}$ E., and the opposite stream about W. by S. $\frac{1}{2}$ S.; the velocity of both streams, at springs, being from 5 to 6 knots; but although the tide runs with such violence near the Race, about a mile S.W. of the Bill the tide was found weak.

At the east end of the Shambles, the 1st hour of the flood by the shore sets West, $1\frac{1}{2}$ knots; 2d hour, from West to N. by E., weak; 3d hour, about E.N.E., weak; 4th hour, E. by N., 2 knots; 5th hour, E. by N., $2\frac{3}{4}$ knots. The 1st hour of the ebb sets E.N.E., $3\frac{1}{2}$ knots; 2d hour, E.N.E., $3\frac{1}{4}$ knots; 3d hour, East, $2\frac{3}{4}$ knots; 4th hour, East and E. by N. $1\frac{1}{4}$ knots; 5th hour, East, N. by W., and W. by N., weak; 6th, 7th, and 8th, about West, from $2\frac{3}{4}$ to $2\frac{1}{4}$ knots.

About $2\frac{1}{2}$ miles west of Portland Bill the flood and ebb streams are of nearly equal duration, setting S.S.E. and N.N.W. The eastern stream ends about 10 o'clock, which is $3\frac{1}{2}$ hours after high water in Weymouth harbour, or $1\frac{3}{4}$ hours before high water in Portsmouth harbour. Five miles W.S.W. from the Bill the stream sets S.E. by E. and N.W. by W., and turn 30m. before high water in Portsmouth harbour. Six miles S.S.W. of the Bill they set E.S.E. and W.N.W., and the eastern stream ends 10m. before high water in Portsmouth harbour.

In Portland and Weymouth roads the stream is scarcely sensible, running with but little strength along the shore from Weymouth to St. Albans head.

At $1\frac{1}{4}$ miles S.S.W. $\frac{1}{2}$ W. from St. Albans head, the western stream makes at 10h. 45m., and the eastern stream at 4h. 45m., the latter setting S.E., and the former W.N.W. to N.W. by W.; their greatest velocity being at half tide about $4\frac{1}{2}$ knots.

One mile S.E. of Durlston head, the western stream makes at 10h. 25m., and the eastern stream at 4h. 25m., the former setting W.S.W., and the latter E.N.E.; their greatest velocity about 3 knots; the indraught on the flood in thick weather is dangerous to a ship not on her guard.

At a third of a mile E.S.E. of Peverel point, the western stream makes at 8h. 40m., and the eastern stream at 4h. 0m., the former setting S.W. and the latter N.E.; on the ebb there is a dangerous race over the ledge, which extends about a mile off the point. The velocity of the ebb is about 3 knots, of the flood about $1\frac{1}{2}$ knots. Off Old Harry, at three-quarters of a mile N.E. by E. from Standfast point, the western stream makes at 9h. 45m., and the eastern at 4h. 10m., the latter setting N.E. by E. to N. by E. at the rate of a knot, and the western stream S. by W. to S.W. 2 knots.

INSHORE STREAMS between PORTLAND and OWERS.*—By reference to the Admiralty Tide Tables it will be seen that while it is high water at one end of the Channel, it is low water at the other end; but this inversion of the tide is sudden, not progressive; for example, the Bill of Portland and St. Catherine point are only 44 miles apart, and yet it is high water at the latter when it is low water at the former, viz., on or about noon on full and change days; in fact, the whole six hours difference is confined within this space; the range of tide being nearly the same in both cases.

It is therefore important for seamen to know that not only does this inversion of tide take place somewhere near the assumed position of the Channel node or hinge of the tide at Swanage, which is equi-distant between these two places; but that in all places westward of the node it is high water, full and change, nearly at the same time, between 5 and 6 o'clock, and at all places eastward of the node between 11 and 12 o'clock. As the tidal streams run everywhere in the Channel at high and low water on the shore at Dover, or at 11h. and 5m. full and change, the western or outgoing stream drains all the harbours eastward of the node, while it is filling those to the westward, and vice versa, the same stream making a high or low water, according as the position is east or west of the Channel node.

Eastern Stream.—From the time of half ebb to nearly the end of the flood in Portsmouth harbour, or from about 2 h. to 11 h., full and change,

* From observations made during the progress of the survey on the south coast of England, by Captain Sheringham, R.N., in 1846-52.

there is an outset from the West bay of Portland of nearly 9 hours duration, which closely skirts the rocky shore and gradually increases in strength as it approaches the Bill, where it acquires such velocity as to extend far beyond that point before it turns to the eastward; leaving a strong eddy stream between it and the land. Having assumed its easterly course, it rushes past the pitch of the Bill at the rate of 6 or 7 knots at springs, leaping and foaming over the broken ground of Portland ledge with great violence.

A short distance eastward of the ledge this outset is met at nearly right angles by a counter stream, which sets for 9 hours out of Portland bay, running with great strength past Godnor point; these united streams press on towards the Shambles,* which they cross obliquely about East at the rate of $3\frac{1}{2}$ knots, clearly pointing out the limits of this bank by a well-defined line of broken water. At the west end of the bank the rate is quite $3\frac{1}{2}$ knots for three-quarters of the tide; at the east end the average rate is about 3 knots; but for the first hour there is scarcely any tide.

The eastern stream, when disentangled from the influence of the Shambles, sets in for the coast to the westward of St. Albans head, soon, however, bending to the eastward in the direction of the shore, sweeping round that head at the rate of 4 or 5 knots at spring tides. At $1\frac{1}{2}$ miles from Durlston head the stream does not appear to set into Poole and Christchurch bays, but within that distance it does so. A little farther off the head it runs for the Needles, and sets dangerously towards the Brook and Atherfield ledges, extending off the south-west shore of the Isle of Wight.

At $2\frac{1}{2}$ miles off Durlston head the stream sets in a slight curve outside St. Catherine point, which it passes at about the same distance, having regained the same velocity as it had off St. Albans head, upwards of 4 knots; to the eastward of the point it is again sucked into the deep bight between the Isle of Wight and the main, but not sufficiently so to overcome its onward course towards the Owers, as it leaves those shoals nearly 5 miles to the northward.

Inner Stream.—Within the stream of tide just described, there is during the flood an inner stream, which at half a mile inside the Shambles sets dangerously into the bight towards the Kimeridge ledges, brushing sharply and closely round St. Albans head, whence it is deflected to the northward round Durlston and Peverel points, but with decreased strength, and having passed Old Harry expends itself in Poole bay. Thence it proceeds slowly round the bay towards Christchurch head, running smartly over Christchurch ledge, but soon relapses into its former tranquil course;

* This dangerous bank is probably the result of the outsets from West and Portland bays, crossing the true channel tides in the two positions at each end of the shoal.

as it approaches the Needles, however, it acquires increased strength, and runs over the Dolphin bank and the Shingles with considerable velocity.

This stream splits off the Needles, one portion running up the Solent, and through Spithead, while the other flows round the south side of the Isle of Wight, following every bend and turn of the coast, until it reaches Bembridge point, where, at about a mile north-east of the Nab, it re-unites with the other portion through Spithead ; and thence these united streams set towards Selsea Bill, into Bracklesham bay, through the Looe, and over the shoals at the rate of 2 or 3 knots, according to the distance off shore.

Western Stream.—The reverse of the foregoing remarks is also applicable to the course of the out-going or western stream, which at $4\frac{1}{2}$ hours after the commencement of the eastern stream in the offing, or at 9h. 30m. on full and change days, has made in shore the whole way from Selsea Bill through Spithead and the Solent to Portland. It may, however, be requisite to repeat, that at any moderate distance from St. Albans head, from one to 2 miles, this stream sets for the Shambles, whereas its inshore portion runs smartly along the coast as far as Whitenore point, losing its strength in Weymouth and Portland bays. From the north-east end of Portland it rushes furiously round Godnor point towards the Shambles and past the Bill, catching up the first of the outset to the south-east out of West bay in its course down Channel.

This stream, near high water in Portsmouth harbour, divides near the Nab, one part running through Spithead, the other over the Princessa shoal and round Dunnose to the westward, until half ebb by the shore. At this period the tide has slacked at Spithead, and the rapid discharge of the last half of the ebb from Southampton water and Portsmouth harbour, produces such an increased velocity in the back water as to turn or beat back from its course the stream at Spithead, converting the western into an eastern stream, which near the Nab meets the regular Channel ebb, and with it sweeps round to the southward of the Isle of Wight. Thus the ebb for the last half of its duration runs in opposite directions on the two sides of the eastern half of the island.

CAUTION.—From the above description of the inshore streams, it will be seen that there is a considerable indraught on both the flood and ebb into all the deep bights from Portland to the Owers, particularly on the flood, round Durlston head into Poole bay, and in some positions more than others, according to the distance off shore.

This indraught has a tendency of leading a vessel into danger, particularly in thick weather, if by neglecting the lead she is allowed to be attracted within its influence. With the land in sight there can be but little risk of this, for anywhere southward of the Shambles, $1\frac{1}{2}$ miles out-

side St. Albans head, 2 miles south of St. Catherine point, and 4 or 5 miles southward of the Owers, a vessel will not be materially affected by indraught on either tide.

At night or in thick weather, suspicion should always be awakened by the appearance of a strong race or overfall, as it indicates either the near approach to some salient point, or the proximity to a shoal; and it may be generally inferred, that 2 miles outside the fair streamage of headlands, there is little or no indraught.

SECOND HIGH WATER.—The inshore stream of flood, as just observed, page 135, splits off the Needles, one part flowing round the south side of the Isle of Wight, the other through the Solent and Spithead. At $4\frac{1}{2}$ hours after the commencement of the offing stream, or at 9h. 30m. on full and change days, the western stream has made inshore all along the coast from Selsea Bill, through Spithead to the westward, increasing its velocity down the Solent to nearly 2 knots, and through the Needles to $3\frac{1}{2}$ knots.

This western stream unites near the Nab with the last of the flood round the eastern end of the island, and together they run through Spithead, giving increased effect to the incoming stream of flood, by contributing to fill the harbours in its progress to the westward, until the stream has turned in the offing, a little after 11 o'clock, thus making a flood or rising tide of 7 hours. This not only affects the rise of tide in Portsmouth, Langston, and Chichester harbours, but it makes what is called a *second* high water in the harbours of the Solent. At Christchurch, Poole, and Swanage, it is more properly a second rise, as it takes place between high and low water. This second flow takes place at Southampton and at Hurst 2 hours, at Christchurch $2\frac{1}{2}$ hours, at Poole $3\frac{1}{2}$ hours, and at Swanage 4 hours, after the *first* high water.

The influence of the second tide continues to be felt as far as Portland, but to the westward of St. Albans head it comes so near the time of low water, and causes so small a rise, that it is called the second low water; the intermediate rise of from 5 to 7 inches being termed the gulder. At Lulworth, the first low water takes place $4\frac{1}{2}$ hours after high water; the gulder then rises for $1\frac{1}{2}$ hours, and the second low water occurs 2 hours after the gulder has ceased rising. At Portland breakwater the first low water is 5 hours after high water, and the second 3 hours later. At the Bill, from the constant swell, the level cannot be spoken of with certainty to inches, but low water continues about 2 hours.

This second rise or swelling of the tide ceases about 12h., full and change, or about the time that the outgoing or western stream in the Channel has acquired strength.

CHAPTER V.

NEEDLES TO SELSEA BILL.—THROUGH NEEDLES AND SOLENT CHANNELS TO SOUTHAMPTON, COWES, AND RYDE; SOUTH COAST OF ISLE OF WIGHT; EASTERN ENTRANCE TO SPITHEAD; AND PORTSMOUTH, LANGSTON, AND CHICHESTER HARBOURS.

VARIAION IN 1869.

Needles channel - 20° 50' W. | Spithead - - - 20° 35' W.

NEEDLES CHANNEL.—Throughout Christchurch bay the land is low, but more especially so in the vicinity of Hurst castle, the base of which is but little elevated above the level of high water. The Needles cliffs, at the west extreme of the Isle of Wight, rise perpendicularly from the sea, and being composed of white chalk, are remarkable from the offing, when contrasted with the dark-coloured ground behind them; these, with the white lighthouse on the outer Needle rock, Hurst castle, the batteries, and two lighthouses on Hurst point, are good guides to the entrance of the Needles channel, which is bounded on the western side by the shoals called the Shingles, and on the eastern by the west end of the Isle of Wight.*

The entrance to this channel, between the west end of Bridge reef and the south-west tail of the Shingles, is nearly a third of a mile wide, the least water in it being 5 fathoms, gravel bottom. With care it may be taken under favourable circumstances by sailing vessels of large draught; steam vessels can navigate it at any time when the leading marks or lights are visible.

With the wind from S.E. by S., round southerly, to North, a sailing vessel, under most circumstances, may take the channel with confidence; but if the wind be to the eastward of South, the channel should not be attempted in ships of large draught, for the course past the S.W. buoy of the Shingles, until within the Bridge reef, is no better than E. $\frac{1}{2}$ N., and on entering the channel the wind generally draws more to the eastward. With scant south-easterly winds, it should never be attempted on the

* See Admiralty Charts: England, South Coast, Dunnose to Christchurch, with Spithead and the Needles, No. 2,128, and Owers to Dunnose, including Spithead, with views, No. 2,045; scales, $m = 1\cdot4$ inches; also Needles, North and South channels, No. 2,219; scale, $m = 5$ inches; and England, South Coast, Sheet 4, No. 2,450, scale, $m = 0\cdot5$ inch.

ebb ; and as a general rule it cannot be recommended to turn through, except in a handy vessel of light draught, under the management of a good pilot, when it is not a hazardous evolution on the flood.

With a smooth sea, vessels of moderate draught may cross the Bridge reef with Hurst lighthouses in line by day and the lights in line by night, bearing N.E. by E. $\frac{1}{2}$ E. ; but if drawing 19 or even 18 feet these marks should not be used at low water springs, as they would lead too close to the shoal water on the reef.

Although the lead should on no account be neglected, it will be of little service, for the tide hustles a vessel so quickly through the channel that the seaman has scarcely time to avail himself of any warning it might afford ; but a marked attention to the soundings is of the utmost importance when approaching the entrance from sea.

As a general rule, from whatever quarter this channel is approached, with the Hurst lights in sight—and it should never be attempted by a stranger unless they are so,—the seaman may be assured that he is nearing the entrance when the depths are under 10 or 11 fathoms, according to the state of the tide, and that even these soundings will bring the vessel close to the rocks if the lights are northward of N.E. by E. ; great caution must therefore be used in approaching the Bridge reef until the lights are eastward of that bearing, and the anchor clear for letting go at a moment's warning.

LIGHTS.—The granite lighthouse on the outer of the Needles rocks is 109 feet high, and exhibits, from an elevation of 80 feet above high water a *fixed* light of the first order, which shows *red* when bearing from N.W. $\frac{1}{2}$ N. (round northerly) to East ; *white* from East to E.S.E. ; *red* from E.S.E. (round southerly) to S.W. by W. ; and *white* from S.W. by W. to S.W. by W. $\frac{1}{2}$ W. The white light is visible in clear weather from a distance of 14 miles, and the red light 9 miles. A bell is sounded during foggy weather.

The mariner should bear in mind that the white light shows in the direction of the entrance of the Needles channel, and that its southern limit bearing East passes $1\frac{1}{2}$ miles south of Durlston head, and about a cable's length south of the outer part of Bridge reef ; and that its northern limit, E.S.E., passes 2 cables south of the Dolphin bank and the S.W. buoy of the Shingles. The ray of white light, between the bearings of S.W. by W. and S.W. by W. $\frac{1}{2}$ W., is to clear the Warden ledge.

The two lighthouses on Hurst point are circular in form (the lower one painted red), and 52 and 85 feet in height. They stand 223 yards apart N.E. by E. $\frac{1}{2}$ E. and S.W. by W. $\frac{1}{2}$ W., the lower light being to the southwest ; and each exhibits a *fixed* white light, elevated respectively 46 and 76 feet above high water, and should be visible in clear weather from dis-

tances of 10 and 13 miles; when bearing northward of N.E. $\frac{1}{2}$ E. they are shut in by the Needles rocks. There is also, in the eastern face of the high lighthouse, a *fixed* white leading light, which shows up the Solent, between the bearings of W. by S. $\frac{1}{2}$ S. and W. by N. $\frac{1}{2}$ N.*

The SHINGLES.—The north-east extreme of these shoals commences, about half a mile from Hurst beach; and thence they extend W.S.W. nearly 3 miles, terminating in two prongs, the south-western of which is very dangerous, having only 5 feet over it at low water. The northern side of the shoals, except near the western or outer end, is of gradual slope, and the approach to it may be tolerably well ascertained by a careful attention to the lead; but their southern or channel side is steep to dropping at once from almost a dry bank to a depth of several fathoms. Caution is therefore requisite in approaching either side, for the numerous shallow heads, the rapidity of the tides, and the great violence with which the sea curls and breaks with the least swell, would entail certain destruction on any vessel which might have the misfortune to be driven on them.

An opinion prevails that the shingles undergo great changes, particularly in southerly gales. It is quite certain that the crown of the bank, or the part subject to the wash and surface scour of the tide, is continually changing according to the state of the weather; for after a long continuance of easterly winds and smooth water high banks are heaped up, which are never wholly covered with the tide, and which usually disappear after strong southerly winds, when the surface frequently becomes so completely levelled as to leave no part visible even at low water. There is no proof, however, that the main body of these shoals is subject to any alteration of consequence either in figure or extent. On the flood the overfalls may be distinctly seen on their southern edge, and during the ebb the ripple on their northern edge.

Milford church seen between the two western houses of Milford N.E. $\frac{1}{4}$ E. (view D) leads clear of the western side of the Shingles and eastward of the east end of the Dolphin bank, the shoalest part of which in 3 fathoms lies N.W. $\frac{1}{4}$ N. $8\frac{1}{2}$ cables from the S.W. buoy of the Shingles.

Nodes beacon on with junction of red and chalk cliffs in Alum bay, E. by S. $\frac{3}{4}$ S., leads south of the Dolphin, and the south-west prong of the Shingles; and the two lighthouses in one N.E. by E. $\frac{1}{2}$ E. clears the southern side of these shoals as far eastward as the Elbow buoy, but leads close to it; and thence the high lighthouse must be opened southward of the low one, to clear the eastern edge of the bank.

* The lower lighthouse on Hurst point is built in by the new fort, the top alone being visible; but outside the fort is placed a red screen which—with the lighthouses in line—fits under the top of the lower lighthouse, and apparently renders the building complete.

Three buoys mark the south-east or channel side of the Shingles; one is placed off the south-west prong, another at the elbow, and the third at the north-east extreme.

S.W. Shingles buoy, conical and chequered red and white, is moored in 7 fathoms water, with Hurst high lighthouse, its own breadth open north of the low lighthouse, bearing N.E. by E. $\frac{3}{4}$ E. ; Nodes beacon in line with the western part of the variegated cliff in Alum bay E. by S. $\frac{3}{4}$ S. ; and Shingles Elbow buoy N.E. by E. $\frac{3}{4}$ E. $1\frac{4}{10}$ miles.

Elbow buoy, can, with red and white vertical stripes, is moored in 7 fathoms water, close to the edge of the bank, with Hurst high lighthouse its breadth and a half open north of the low lighthouse, bearing E.N.E. northerly ; Needles lighthouse S.S.W. $\frac{1}{2}$ W. ; and N.E. Shingles buoy N.E. by E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles.

N.E. Shingles buoy, can, with red and white horizontal stripes, lies in 7 fathoms water, near the north-eastern extremity of the Shingles, and marks the south side of the entrance to the north channel. From it Hurst high lighthouse bears N.E. by E. $\frac{1}{4}$ E. eight-tenths of a mile ; Warden ledge buoy S.E. $\frac{1}{2}$ S. half a mile ; and Needles lighthouse S.W. $\frac{1}{4}$ W.

Bridge reef extends upwards of three-quarters of a mile, about W. by S. from the Needles lighthouse, thus narrowing the 5-fathom channel between its western extreme and the south-west prong of the Shingles to a third of a mile. The three Needles rocks in one, lead along the backbone of this dangerous reef, which is very narrow towards the western end, and steep-to on both sides. On the ebb tide the position of the reef is distinctly marked by great overfalls ; in quiet moderate weather by the ripple ; and during southerly gales by a well-defined line of broken water. With much ground-swell, which always accompanies southerly winds, and even rises with an impending breeze from that quarter, the sea breaks with great violence for a considerable distance from the lighthouse.

The heads of this reef are so numerous and irregular that vessels of large draught should not cross it nearer to the rocks than to have the south end of Hill farm trees just within or south of Warden point, E. $\frac{1}{2}$ N. The north end of the trees kept just within the point, will lead close to a 19-foot rock ; whilst to the eastward of this line the reef becomes more dangerous as the Needles rocks are approached. Hill farm trees open north of Hatherwood point bearing E. by N., leads westward of all the shoal heads under 2 fathoms but close to the 6-foot rock near the Goose.

Pepper rock open of Sun Corner E. by S. (view N.) leads 2 cables south of Bridge reef ; it also leads south of St. Anthony rock and a rock awash, both of which lie eastward of the Needles rocks in Scratchell bay, and are dangerous for small vessels making too free with the shore. St. Anthony rock dries at low water springs, and lies a cable W. by N. $\frac{1}{2}$ N. from Sun

Corner; the rock awash is upwards of a cable outside it, on the same bearing.

Two dangerous heads, which appear to be the continuation of a ledge running out of Alum bay, parallel with and close to the shore, lie N. W. by N. about half a cable's length from the outer Needle rock. The inner head dries at low water springs, and is called the Goose; the outer head, with 6 feet water on it, lies a little to the northward.

CAUTION.—Small vessels anxious to avoid the strength of the ebb tide by getting into Alum bay, are cautioned against hugging the Needle's lighthouse too close; they should give it a berth of 150 yards at least, for, independently of the sunken rock above alluded to, there are many others equally dangerous for some distance outside the lighthouse.

Five Rocks is the name given to a small rocky patch of 3 feet water, lying S.W. from Hatherwood point, and $1\frac{1}{2}$ cables off shore; but it is only dangerous to small vessels which anchor in Alum bay, or turn to windward close in shore to avoid the tide. The north end of Hill farm trees open of Hatherwood point E. by N. (View O.) will lead westward of it; and the north end of the same trees kept just within Warden point, will lead outside the rocky ledges which extend upwards of a cable's length off Hatherwood point.

Tinker Patches.—Between Hatherwood point and Cliffs-end, the bottom is nearly all foul, and various names have been adopted to identify the most dangerous of the numerous shoal rocky patches which extend to a considerable distance from the shore. The large and dangerous field of rocks, named Tinker patches, bounds the north-east side of the anchorage in Totland bay, to which it affords a most valuable shelter. The least water on them, 9 feet, is near the western limit of the shoal, about half a mile off shore; and lies with the south end of Hill trees in line with Warden point.

Warden ledge is a dangerous reef of rocks which dries for above half its length at spring tides, and extends N.N.W. 4 cables from Warden point, at which distance there are only 9 feet at low tide, with deep water close to outside.

The buoy, can and red, lies in $5\frac{1}{2}$ fathoms close to the outer edge of the ledge, with Hurst low lighthouse N. by E. $\frac{1}{4}$ E.; the flagstaff of Victoria fort just seen over the low part of Cliffs-end E. by N. $\frac{1}{2}$ N.; and Needles lighthouse S.W. by W. $\frac{1}{2}$ W.

How reef, ledge, and bank.—Between Warden point and Cliffs-end distant four-fifths of a mile in a north-easterly direction, is Coldwell bay, from the depth of which How reef and ledge runs out in a direction parallel with the dangers off Warden point upwards of one-third of a mile,

with as little as 6 feet water on its outer edge; and thence with a sweep to the northward the 2-fathom line of How bank falls back towards Cliffs-end.

As shoal rocky ground extends all the way between the outer end of Warden ledge and the off-lying rocks at Cliffs-end, vessels of even light draught should not approach nearer the shore than to have the whole of Victoria fort on Sconce point open of Round Tower point. A good berth should also be given to Cliffs-end point, as detached heads lie upwards of a cable's length outside it; but thence to Sconce point the shore may be approached to a cable's length, as there are no off-lying dangers.

Mineway bank, a shoal patch of foul ground with only 9 feet water, lies at the western entrance of the North channel, between the Shingles and Hurst beach, about a third of a mile from the latter. The low lighthouse at Hurst, nearly on with the south end of the trees at West hill, leads well to the southward; and Milford church seen between the two western houses of Milford, N.E. $\frac{1}{4}$ E., leads half a cable to the westward.

The North Head is a dangerous gravel knoll, with only 9 feet water, lying on the southern side of the North channel, and narrowing the passage between it and the beach to a third of a mile. A vessel will be abreast the knoll when Milford church bears N. $\frac{1}{4}$ E., and to the northward when the flagstaff at Sconce point opens northward of the low lighthouse, E.S.E. The extremes of Hurst and Sconce points touching, lead over it.

The Trap is a small spit of sand and gravel, thrown up at Hurst point by the strong eddy tide on the ebb; and although near the beach, and steep-to, it is much in the way of vessels hugging the point to avoid the tide, and should therefore be given a fair berth.

ANCHORAGE.—The anchorage in Alum bay is only resorted to by yachts or small vessels, as there is much foul ground in it, and to avoid the tide they anchor close in shore. The best position is in 3 to $3\frac{1}{2}$ fathoms, with the junction of the red and chalk cliffs bearing about S.E., and Hatherwood low point and Cliffs-end in line, N.E. by E. $\frac{1}{2}$ E.

Totland bay affords excellent shelter for vessels of moderate draught, particularly in easterly winds, being well protected by the Tinker patches and Warden ledge. The best anchorage is on the southern side of the bay, in $3\frac{1}{2}$ to 4 fathoms, over sandy bottom, with the Needles point and Hatherwood point in one, W.S.W.; and Nodes beacon over the west end of a small plantation at the bottom of the bay, S. $\frac{1}{4}$ E. Little or no ebb tide will be felt, and the flood is not strong enough to impair the security of the anchorage.

TIDES.—It is high water at the Needles at full and change, at 9h. 46m.; springs rise $7\frac{1}{2}$ feet, and neaps 5 feet. At Hurst the first high water is at

10h. 0m., the second at 12h. 0m., and low water at 3h. 40m.; springs rise $7\frac{1}{2}$ feet, and neaps 6 feet. The flood or eastern stream makes at 3h. 40m., and the western stream at 10h. 0m., and the velocity of both over the Bridge and in the Needles channel is from 3 to 4 knots; but between Hurst point and the island shore $5\frac{1}{2}$ knots, whilst to the southward of the Bridge it is only about 2 knots.

There is no indraught into the Needles channel on the flood unless within about $1\frac{1}{2}$ cables' of the lighthouse. A quarter of a mile outside the lighthouse and off Sun Corner the direction of the flood stream is S.E. $\frac{1}{2}$ E. about $1\frac{1}{2}$ knots. The ebb sets smartly across the Bridge reef, about W.S.W., but gradually trends to the westward about half a mile from the reef, where its direction, which is the fair tide, is W. by N. $\frac{1}{2}$ N., with a rate of $1\frac{1}{2}$ knots at springs. The stream turns nearly with the tide on the shore at Hurst.

At the entrance of the channel, or between the S.W. buoy and the west end of Bridge reef, the flood sets directly through the fairway S.E. by E. $\frac{1}{4}$ E. towards the Needles lighthouse, but turns rather abruptly to the eastward about half-way between the south-west prong of the Shingles and the lighthouse, with a velocity at springs of at least 3 knots. It then continues to run along the island shore, sweeping the bays, and over the shoals between Hatherwood and Sconce points, at the rate of about 4 knots at springs, and nearly 3 knots at neaps. In mid-channel the flood sets fairly up between the points with about the same strength.

Near the Needles channel edge of the Shingles, the flood sets to the eastward right off the bank for some distance before it bends to the north-eastward, and thus acts as a safeguard. On this side of the channel its velocity is not great, until it begins to feel the influence of the North channel tide, when it acquires great velocity, about $5\frac{1}{2}$ knots at springs and 3 knots at neaps.

It may be gathered from the above observations that all danger upon the flood lies on the island side, indeed it would be a matter of some difficulty in light winds to ground upon the Shingles with a flowing tide.

The ebb splits about a third of the way between Hurst point and Cliffs-end, one part running through the North channel and the other setting obliquely across the Needles channel and over the Shingles, between the N.E. and Elbow buoys with considerable velocity. In any position in the Needles channel to the northward of the Warden ledge buoy the indraught of the North channel is powerfully felt, and therefore great prudence is necessary not to get within its influence in light and baffling winds; for, if on the Hurst side, a vessel would probably be swept through that channel, and if on the island side, she would be carried on the Shingles, unless quick in anchoring. The seaman's safeguard, there-

fore, in light winds with an ebb tide is to keep well over on the island shore until abreast the Warden buoy, and thence the tide will set clear of the Shingles.

Anywhere between Warden ledge and Sconce point a vessel will be more or less affected by the influence of the North channel tide, and therefore might be carried either through that passage, or so far to the northward as to be in danger of the Shingles. In mid-channel between Warden ledge buoy and Hatherwood point, the tide takes the course of the deep water. Abreast Hatherwood point the influence of the outset at the entrance begins to be felt, and in calm weather would take the vessel safely through the channel, between the tail of the Shingles and the Bridge reef with a velocity of nearly 4 knots at springs.

There is no appreciable tide on the ebb in the various little bays on the island side, as it is deflected by the shoals; but beyond Alum bay small vessels should not approach the Needles rocks or the north side of the Bridge reef very closely, as the tide runs over it with considerable strength.

The flood tide sets fairly through the North channel, taking the course of the deep water, and runs with great rapidity from the elbow in Hurst beach, called Put-off point, to its confluence with the Needles channel flood, which takes place about 2 cables south of the point, and distinctly shows itself by a turbulent broken sea. At the western entrance its rate is from 3 to $3\frac{1}{2}$ knots at springs and 2 at neaps; but from Put-off point to the eastward it increases to a race, with a velocity at springs of at least 5 knots. A strong eddy which runs between the meeting of the tides and the point must be carefully avoided, for in it a vessel would become totally unmanageable.

It has already been observed that the ebb splits about a third of the way between Hurst point and Cliffs-end. That portion which runs through the North channel sweeps gradually but with considerable force round Hurst point, causing a strong counter tide in-shore. Like the flood it follows the direction of the channel, and sweeps round Christchurch bay, gradually diminishing in strength as the narrows are past. Its rate off Hurst point is about 4 knots at springs and 3 knots at neaps, and to the westward of Put-off point from $1\frac{1}{2}$ to $2\frac{1}{2}$ knots. The stream turns to the westward a little before high water by the shore, and runs about six hours each way.

At the back of the Shingles both flood and ebb are regular, and have no great strength between the S.W. buoy and the North channel. The direction of the flood is from E. by S. at the first quarter, to S.E. $\frac{1}{2}$ E., which is its course at half tide, setting across the Shingles. At a mile from the edge of the bank, its greatest rate at springs is about $2\frac{1}{2}$ knots, but it runs with much greater rapidity over the bank. The direction of the ebb is from N.W. by W. to W. by N., from one to $1\frac{1}{2}$ knots. The

turn of the stream is uncertain, but it has been found to run to the eastward from about one hour before the time of low water by the shore.

DIRECTIONS.—From about 3 miles south of the Bill of Portland, an E. $\frac{1}{2}$ S. course for about 15 miles, and, after passing St. Albans head East 17 miles, allowing for tide, will take a vessel to the entrance of the Needles channel. A stranger, however, when nearing the entrance, should be careful to keep Nodes beacon well open to southward of the Needles lighthouse until one of the leading marks comes on.

Crossing Bridge Reef.—If intending to cross the Bridge, steer in with Hurst lighthouses in line, N.E. by E. $\frac{1}{2}$ E., and when well within the reef, or when the Needles lighthouse bears S.E. $\frac{1}{2}$ E., or is in one with Sun Corner, edge a little to the northward, if the tide is flowing, to avoid being set too close to the island shore.

As the Elbow buoy of the Shingles is approached, keep Hurst high lighthouse open its own breadth southward of the low one; bearing in mind that the Needles lighthouse must not be brought westward of S.W. by W. until the whole of the Victoria fort on Sconce point opens of Round Tower point, (View E.) to clear the Tinker, Warden, and Howe ledge and bank. When Warden ledge buoy is passed, borrow a little towards the island shore to avoid the eddies off Hurst point.

After passing Cliffs-end, the seaman must act according to circumstances, recollecting that the flood sets strongly for more than half the distance to Sconce point, when it strikes across for the Lymington shore towards Jack-in-the-Basket beacon; and that from Hurst road the ebb runs for Nodes beacon until the North channel opens out, when it turns rather suddenly to the westward through that channel. There is a strong eddy on the flood close in shore on the island side.

Entering by Needles Channel.—Approaching the entrance from the southward with a fair wind, Hurst high lighthouse bearing E.N.E., will lead towards the S.W. Shingles buoy, until the south end of the trees at Hill farm is just within or south of Warden point, E. $\frac{1}{2}$ N. (View F.) This latter is the leading mark between the Bridge reef and the south-west prong of the Shingles, until Hurst lighthouses are in line, N.E. by E. $\frac{1}{2}$ E., when proceed up channel as before.

Approaching from the westward, steer in with Nodes beacon in line with the junction of the red and white cliffs in Alum bay, E. by S. $\frac{3}{4}$ S. (View A), or the Needles lighthouse E.S.E., and when the south end of the trees at Hill farm is just south of Warden point, or the Hurst lighthouses are in line, proceed as before.

Turning through.—No vessel should attempt to turn through the Needles channel, except under able management; and in doing so it must

be borne in mind that on the flood the Shingles is the safe side, and that, in standing to the northward, Sun Corner must be kept well open of the Needles lighthouse—for these points touching is a scraping mark for the south-west prong of the Shingles—and not to cross the Bridge farther eastward than to have the north end of the trees at Hill farm touching, or in line with Warden point.

Working out on the ebb, when standing to the westward in the vicinity of the Elbow buoy, Hurst high lighthouse should not be brought within its own apparent breadth of the low lighthouse, as the ebb sets strongly over the Shingles. Perhaps it would be advisable, when abreast Hurst beach, to throw the vessel's head towards the island, and drop her out with the tide. At night, the ray of *white* light from the Needles lighthouse will be found a useful guide for going about when standing to the eastward in the vicinity of Warden ledge; but in making the western board, as soon as the *red* light opens take care not to bring the Hurst lights in one—as they will be found to close rapidly on the ebb—in order to avoid the strong indraught of the North channel, as well as a highly dangerous approach to the Shingles.

At Night, the Needles channel may be considered safe with clear weather, a fair wind, and moderate attention, recollecting that, in entering from the westward, the southern limit of the Needles *white* light, bearing East, passes about $1\frac{1}{2}$ miles south of Durlston head; and that its northern limit E.S.E., passes about 2 cables south of the Dolphin bank and the S.W. buoy of the Shingles.

A sailing vessel approaching from the westward, with the wind to the southward of West, and having crossed the northern limit of the red light, should steer in with the *white* light bearing E. by S. until the high light at Hurst bears E.N.E., when the S.W. buoy of the Shingles will be nearly in the same line, and the high light will be seen a little to the northward of the low light. Keep the Hurst lights in this position until the Needles *white* light bears E. by S. $\frac{1}{4}$ S., or before it changes its colour to red, when edge *quickly* to the eastward to bring the Hurst lights in line, N.E. by E. $\frac{1}{4}$ E.; then steer about E.N.E., and proceed up the channel with the high light a little open southward of the low light, which as already observed is necessary in passing the Elbow buoy. As the vessel nears Hurst take care to avoid the eddy tide on the flood off the point, and the indraught of the North channel on the ebb.

With the wind to the northward of West, a vessel may steer E.S.E. near the northern edge of the *white* light, until the high light at Hurst bears E.N.E., then edge to the eastward to get the Hurst lights in line and proceed as before. So long as the depths are not less than 10 fathoms at low water, the vessel will be well to the southward of the Dolphin bank; but soon

after the Hurst lights are brought to the northward of E. by N. $\frac{1}{2}$ N., they will decrease from 9 to 7 fathoms, which will be a warning of a near approach to the entrance. When in the fairway the soundings may decrease to less than 5 fathoms, but as soon as they deepen to 10 fathoms, she will be well within the tail of the Shingles and the Bridge reef.

Approaching from the southward, steer in under easy sail with Hurst high light E.N.E., and the first cast under 10 fathoms will be a warning that the vessel is about a mile from the S.W. buoy. Keep the light on this bearing, the soundings gradually decreasing to 6 or 5 fathoms, until the Needles *white* light bears E. by S. $\frac{1}{2}$ S., when edge *quickly* to the eastward to get the Hurst lights in line, N.E. by E. $\frac{1}{2}$ E.; and proceed as before.

Proceeding out of the Needles channel with the ebb, when abreast Hurst, keep the *white* ray of the Needles light well in sight, S.W. by W. $\frac{1}{4}$ W., to avoid the indraught of the North channel, and the ledges on the island side. When past Warden ledge the Needles *red* light may be opened a little; taking care to keep the high light at Hurst open southward of the low light until well below the Elbow buoy, or until the Needles light bears S.S.W., when Hurst lights may be brought in line. Directly the Needles light changes its colour from red to white the vessel will be clear of the Shingles, and if of large draught, should keep to the westward to avoid Bridge reef.

NORTH CHANNEL.—There are occasions when the passage by the North channel, between the Shingles and Hurst beach, will be found of great advantage, particularly to steam-vessels of moderate draught. It is also quite safe for any vessel not above 15 feet draught, provided the wind be free enough to allow her to shape a course by the marks; but as the channel is narrow and tides strong, vessels only of light draught should attempt to turn through,—and even then some practical knowledge is essential,—bearing in mind that the rise and fall is only from 5 to 7 feet, and that the tide stands at the high level for two or three hours.

With North or N.E. winds a vessel with the ebb might work to the northward with great advantage at the back of the Shingles, observing, in standing eastward, not to bring Milford church to the northward of N.E. $\frac{1}{4}$ E. until Hurst point is seen coming on with Sconce point, when it will be quite safe to keep to the eastward, gradually bringing the low lighthouse a little to the northward of the south end of West hill trees S.E. by E., $\frac{3}{4}$ E. (View C) which will lead through the North channel in not less than 17 feet at low water. With this mark on, she may run pretty close to the beach, which is steep-to, altering the course when necessary to keep about half-way between the N.E. buoy of the Shingles and Hurst point; with the flood she will be quickly carried past the point, but care should be taken to keep outside the eddy off Trap spit.

It would be useless attempting the North channel against the ebb, unless in a steam vessel, or with a fresh leading wind ; if, however, it should be deemed practicable, take care that, in keeping close to the beach to cheat the tide, the vessel is not run upon the Trap.

SOLENT CHANNEL, comprised between Hurst point and the entrance of Southampton water, has no dangers in it but the Solent banks. Long mud flats, interrupted only by narrow creeks, leading into Lymington and Beaulieu rivers, run off the northern shore, and several rocky ledges off the island shore.

HURST ROAD, on the north-east side of Hurst point, affording bad anchorage in easterly and south-east winds, is seldom used, in consequence of the uncertain eddies, which render it almost impossible to keep a clear anchor. Small vessels sometimes bring up, and a few of them can lie snugly out of the tide in a good depth of water over a clean bottom, at a moderate distance from the beach, but not nearer the mud than to have the middle Needles rock on with the eastern side of Hurst castle or just over the point.

ELECTRIC TELEGRAPH.—An electric submarine cable is fixed about 400 yards westward of the west wing of Victoria fort on Sconce point ; and thence it extends in a direct line across the Solent to the central towers of Hurst castle, and vessels are cautioned not to anchor on that line of direction, lest by doing so they damage the electric cable, or lose their anchors.

There is a telegraph station near Hurst castle, from which the arrival and departure of vessels off the Needles can be signalled to any of the places embraced by the Electric and International Company's systems, or to any place on the continent of Europe. Vessels can also have their numbers reported, or messages forwarded, as they pass the Solent.

YARMOUTH ROAD.—The town of Yarmouth, at the mouth of the little river Yar, possesses a convenient port for small vessels, with an excellent quay, and valuable shelter is afforded by means of a substantial breakwater. The village of Norton stands to the westward of the town. The river rises close to Freshwater Gate, and almost insulates the western extremity of the Isle of Wight ; it is navigable as high as the Freshwater mills. Two pilot boats and 16 small vessels belong to the port. The population in 1861 was 800. A constant steam communication is kept up with Lymington, Portsmouth, Cowes, Ryde, and Southampton.*

The road affords good shelter from all but easterly winds, especially those between E.S.E. and N.E., when it becomes much exposed. Vessels of

* See Admiralty Plan of South Yarmouth, No. 1,784 ; scale, $m = 20$ inches.

moderate draught should anchor about a third of a mile from the shore in 7 fathoms, good holding ground, and little tide, with the mast on Sconce point bearing W. by N., and Yarmouth church and castle masts in line S. $\frac{1}{4}$ W.; but if of large draught they should take up an outer berth in 8 or 9 fathoms, where the tide runs E.S.E. and W.N.W. about $2\frac{1}{2}$ to 3 knots at springs.

LIGHTS.—Two *fixed* lights are exhibited at Yarmouth, the outer one *green*, from a lamp-post on the quay near the castle wall, and the inner one *white*, from the corner of a house. They are 30 yards apart, each 12 feet above high water, and when in one, S.S.W., lead into the harbour in 14 feet at high water springs.

Black Rock.—When running for these roads from the westward, take care to avoid a dangerous ledge called Black rock, the greater part of which dries at low water springs. It lies about a quarter of a mile westward of the anchorage, and as foul ground extends some distance outside it, do not approach nearer than to have the conspicuous high tower of a house called the Refuge, open to the northward of the old castle at Yarmouth, S.E. $\frac{1}{4}$ S.

A red can buoy lies in $10\frac{1}{2}$ fathoms water, a little outside and to the northward of the rock, with the west end of Tapnel farm open of east end of Sand house at Yarmouth bridge, S.E. by E. $\frac{1}{2}$ E.; the jetty at Sconce point W. $\frac{1}{4}$ S.; Lymington spit buoy N.N.E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles, and Hampstead ledge buoy East about $3\frac{1}{2}$ miles.

Fiddlers Race.—A short distance outside the Black rock there is a deep hole, which must be carefully avoided by boats when blowing hard during a weather tide, as it occasions a great overfall of the tide, and sometimes the sea is alarming. It is known to the local fisherman as the Fiddlers race.

LYMINGTON RIVER flows through the mud bank fronting the northern shore of the Solent opposite Yarmouth, and has on the western side of its entrance a can buoy, chequered red and white, placed in 12 feet water on the spit which runs out a considerable distance, and is even nearer Yarmouth than the north shore and a large ball beacon known as Jack-in-the-basket. No stranger should attempt to enter the river without a pilot.

Entering the river at high water, keep Jack-in-the-basket in line with Lymington church, N.N.W., until near the chequered red and white buoy, which may be passed pretty close, as well as the perches, all of which should be left on the port hand. Abreast the town there are 14 feet at high water springs, and 11 feet at neaps. The trade is mostly confined to coasting vessels.

Small vessels will find better anchorage and less tide in Lymington road than off Yarmouth. Anchor in 5 fathoms, over sand and mud, with Jack-in-the-basket in line with Lymington church, N.N.W., and Hill trees on with Norton house, S.W. $\frac{1}{2}$ W. To avoid the Lymington banks at night, keep the Needles light shut in with Cliffs-end fort.

NEWTOWN RIVER flows into the Solent $3\frac{1}{2}$ miles eastward of Yarmouth, and about half a mile within its mouth divides into three creeks, the eastern of which leads up to the small village of Newtown, about a mile from the entrance. Spring tides rise here $2\frac{1}{2}$ feet more than they do at Yarmouth. The Newtown gravel banks extend in some places about half a mile off the eastern side of the entrance, and are much in the way of small vessels when hugging the shore to keep out of the tide.

Solent Banks are formed by an accumulation of loose shingle, and lie in the fairway of the channel, about half way from Sconce point to Egypt point, near the spot where the first of the flood through the Needles meets the last of the ebb. They are upwards of three-quarters of a mile long, E. by N. and W. by S., and 2 cables wide; and having only 22 feet over their shoalest head, should be avoided by vessels of large draught at low water. From their shoalest head, the western edge of Hill farm trees is in line with Yarmouth sand-house, W. by S. $\frac{1}{4}$ S., and the coast-guard shed at Fish-house point, is in line with the large chalk pit on the distant down S. by E. $\frac{3}{4}$ E. The low lighthouse at Hurst bearing West will lead to the southward.

Hampstead ledge extends 2 cables in a north-west direction from Hampstead point, 3 miles eastward of Yarmouth.

A red can buoy is placed in 5 fathoms on its north-east end, distant a quarter of a mile from the shore, with the N.E. end of trees on Hampstead point in line with the N.E. end of Saltern park S.E. by E.; Egypt point, with Gurnet buoy nearly in line E. $\frac{1}{2}$ N.: Pitts Deep coast-guard houses N. by W. $\frac{1}{3}$ W.; and Salt Mead buoy East.

Salt Mead ledge.—Midway between Hampstead and Gurnet ledges, and nearly half-a-mile from the shore of Thorness wood, is Salt Mead ledge, a patch of foul ground with $2\frac{1}{2}$ fathoms, which is much in the way of small vessels when hugging the shore to keep out of the tide.

A red can buoy is placed in 5 fathoms on its north-east edge, with Egypt point bearing E. $\frac{3}{4}$ N. (the Gurnet buoy appears a little outside the point); Luttrell tower a little within Stansore point, N.E. $\frac{1}{2}$ E.; Pitts Deep coast-guard houses, N.W. $\frac{1}{3}$ W.; Lepe Middle buoy, N.E. $1\frac{2}{10}$ miles; and Gurnet ledge buoy E. by N. 2 miles. The Mount trees at Yarmouth in one with Hill farm trees, W. $\frac{1}{2}$ S., clears both this ledge and the gravel banks on the east side of the entrance of Newtown river.

Gurnet ledges.—About $1\frac{1}{2}$ miles westward of Egypt point is Gurnet head, off which are a series of rocky ledges. Those that extend three-quarters of a mile eastward from the head, and nearly parallel to the shore, are named Gurnet ledges, and their eastern extreme is marked by a red can buoy moored 2 cables off shore, in 8 fathoms water, with Gurnet bay coast-guard houses S.E. $\frac{1}{2}$ E.; Lepe Middle buoy N.W. by N. $1\frac{1}{10}$ miles; and West Bramble buoy E.N.E. $2\frac{2}{10}$ miles. Egypt house open north of the old lime kiln, E. $\frac{1}{4}$ N. (View M), leads outside the buoy, but will not clear the rocks to the eastward of it in Gurnet bay.

Lepe Middle, a shoal lying on the northern shore of the Solent off the entrance to Beaulieu river, projects about a mile from the shore, and lies well to the northward of the fairway course to and from Spithead; but being the turning point into Southampton water, it is marked by a conical buoy, with red and white vertical stripes, placed in 4 fathoms water, with the inner beacon at Lepe its apparent width east of the outer beacon, N. by E. $\frac{3}{4}$ E.; and Old Castle bathing house open of Egypt point, S.E. by E. $\frac{1}{2}$ E.; West Bramble buoy, E. $2\frac{1}{2}$ miles.

Luttrell tower, a conspicuous building between Stansore point and Calshot castle, kept open east of Stansore point, N.E. $\frac{1}{4}$ E. (View G), leads eastward of the buoy and over the eastern tail of the shoal in 4 fathoms; and Hill head coast-guard houses, midway between the large chalk pit and Nelson's monument on Portsdown hill, E. $\frac{3}{4}$ N., leads south of the buoy and over the tail of the shoal in the same depth.

BEAULIEU RIVER.—The entrance, which is about three-quarters of a mile westward of Stansore point, has a mud bar, over which there are but 2 feet at low water springs, but there are depths of 4 and 5 fathoms within. The two red beacons standing on the shore close to the westward of the coast-guard buildings, when in one N. by E. $\frac{1}{4}$ E., show the deepest water over the bar; after which the channel is marked by perches. Springs rise $11\frac{1}{2}$ feet at the entrance, and neaps $9\frac{1}{2}$ feet. The springs rise 10 feet at Bucklers hard, 4 miles up the river, where in former years some frigates were built, but the practice of building vessels there is now discontinued. There is no trade.

COWES ROAD and HARBOUR.—Three-quarters of a mile eastward of Egypt point is Cowes road, and the entrance of Cowes harbour, which is the principal port of the Isle of Wight, and the station of the Royal Yacht squadron. The town of Cowes stands on the East and West banks of the river Medina, which is navigable for vessels of light draught to Newport, the capital of the island. At the narrowest part of the river there is a floating bridge connecting East and West Cowes. Constant steam communication is kept up with Southampton and Portsmouth.

Cowes is a place of great resort for bathing and yachting, and has considerable trade. It is also noted for its ship-building yards and dry docks, the principal of which belong to Mr. John White. The largest dock, in which H.M.S. *Melville*, and several 74-gun ships have been repaired, is 330 feet long, 56 feet wide between gates, and has 16 to 17½ feet over sill at high water springs; their other dock is 140 feet long, 36 feet wide between the gates, and has 12 to 13 feet over sill. They have also a patent slip, capable of taking up a ship of 500 tons burthen.*

Cowes road is a safe anchorage, much frequented by yachts and merchant vessels waiting orders. The usual anchorage is in from 5 to 7 fathoms water, with Cowes castle W. by S. ½ S., and the sea mark on Old Castle point, S.E. Pilots are always in attendance to conduct vessels into Cowes harbour or Southampton water, and strangers bound to these places would do well to avail themselves of their assistance.

Two black mooring buoys are laid down between the Prince Consort shoal and Old Castle point, for the use of Her Majesty's yachts.

Cowes harbour has from 9 to 14 feet in it at low water, and 21 to 26 feet at high water springs. A black buoy marks the spit at the eastern point of entrance, and the channel which is on the west side of the buoy is half a cable wide, and marked on its eastern side by two black buoys. The water flows into the harbour 7¼ hours, and ebbs about 4½ hours; the tide runs with great strength.

TIDES in the SOLENT.—As before stated (page 136) the western stream through Spithead has great influence over the rise and fall of tide in the harbours of the Solent, and even to the westward. With spring tides there are two high waters on the shore in Cowes harbour. On full and change days, the first high water is at 10h. 45m.; the tide then falls one or two inches, and again rises two or three inches and makes a second high water at 11h. 45m.; the tide then falls till low water, which is at about 4h. During neaps there is only one high water. Springs rise 12½ feet, and neaps 9½ feet.

At Yarmouth it is high water, full and change, at 10h., and again at 12h., and low water at 3h. 30m.; spring rise 7 feet, and neaps 6 feet. In Lympington river it is high water at 10h. 25m., and again at 12h. 15m., and low water at 4h.; springs rise 8 feet, and neaps 6 feet. At Calshot castle it is high water at 11h. 30m., and low water at 4h.; springs rise 13 feet, and neaps 9½ feet.

At 10h. the tide slacks at the Needles, at which time it is also high water at Yarmouth. The tide there then falls from four to six inches, but in half an hour, or at 10h. 30m., the western stream has acquired strength in the

* See Admiralty Plan of Cowes Harbour and River Medina, No. 2,793; scale, $m = 20$ inches.

Solent, by which the water is again accumulated, and rises to its former level, thus making a second high water at about noon. An uniform fall or ebb then takes place until low water at 3h. 30m., about the same time as the stream slacks near the shore.

There is a considerable difference in the rise and fall of tide at Yarmouth and Lepe; a spring tide falls about $2\frac{1}{2}$ feet lower, and rises about $2\frac{1}{2}$ feet higher at Lepe and at Cowes than it does either at Yarmouth or Hurst.

At the Solent banks the stream turns to the westward at 9h. 30m., and to the eastward at 4h., and the greatest velocity of both streams is $3\frac{1}{2}$ to 4 knots. Near Calshot light-vessel the streams are rotary, and turn nearly at the same time as at Spithead. To the westward of the Bramble in the fairway, the flood makes about $1\frac{3}{4}$, and the ebb $1\frac{1}{4}$ hours later than at Spithead.

In Cowes road the eastern stream makes at 3h. 30m., the western at 9h. 50m.; velocity 3 to $3\frac{1}{2}$ knots.

DIRECTIONS.—There are no dangers in the fairway of the Solent but the Solent banks, and as no clearing marks, intelligible to a stranger, can be given, vessels of large draught had better pass between them and the island shore.

To avoid the long mud flats which extend off the northern shore of the Solent, do not bring the high lighthouse at Hurst to the southward of W. $\frac{1}{4}$ S. until abreast Egypt point, nor come into less than 6 or 7 fathoms water.

Hill farm trees on with the east end of the north side of Yarmouth, and well open northward of the Mount trees at the east end of Yarmouth, bearing W. $\frac{3}{4}$ S., leads in the fairway from off Hampsted point to Egypt point.

A safe rule for vessels turning to windward along the southern shore from Hampsted to Egypt point, is to keep a good half mile off shore and not go into less than 8 or 7 fathoms water. Egypt point is bold on its northern face, and may be passed about $1\frac{1}{4}$ cables' lengths.

At night the light shown in the eastern face of the high lighthouse at Hurst kept on a West bearing will lead south of the Solent banks, and up to Egypt point. When Calshot light bears N.E. the vessel will be a little westward of Cowes road, in which she may safely anchor for the night; or if intending to proceed on to Spithead, the course will be S.E. by E. to pass between the Ryde Middle and the Mother bank, until the light on Ryde pier bears S.S.E.; the vessel will then be eastward of the east buoy of the Middle, when it will be necessary to steer E.S.E. to give the Sturbridge a good berth and to reach the anchorage.

Bramble Bank, is a vast accumulation of sand and gravel which nearly blocks up the entrance of Southampton water; a small part near the west

end has been heaped up into a knoll, which dries at low tide. There are 3 fathoms water along the southern edge of the bank, 8 fathoms at the distance of 2 cables, and 11 and 12 fathoms between it and Cowes road.

Three buoys mark the Bramble shoal, viz., the West Bramble buoy, conical and chequered red and white with cage, which lies in $4\frac{3}{4}$ fathoms at the south-western extremity of the shoal, with Lepe Middle buoy West $2\frac{1}{2}$ miles; and Prince Consort buoy, on the south side of the channel S. $\frac{1}{4}$ W., five-sixths of a mile.

The N.W. Bramble buoy, can, red, in 25 feet, lies N.N.E. four-tenths of a mile from the West Bramble buoy; and the East Bramble buoy conical with red and white vertical stripes, lies in 19 feet water, with West Bramble buoy W. by N. $\frac{1}{2}$ N. $2\frac{1}{2}$ miles; West Middle buoy W. by S. $\frac{1}{4}$ S. $1\frac{3}{10}$ miles; and East Middle buoy S. by E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles.

Calshot spit is an extensive shoal running off Calshot castle, which stands on the extreme of the long, low, and shingly point, at the western side of entrance to Southampton water. A black, refuge buoy is moored in 4 fathoms, on the south-eastern spit of the shoal, one mile S. $\frac{1}{2}$ E. from the castle, and nearly two-thirds of a mile W. by S. from Calshot light-vessel; there is also a black buoy marking its eastern edge, at nearly 4 cables S.S.E. $\frac{3}{4}$ E. from the castle.

Thorn Knoll, upwards of half a mile long, with $2\frac{1}{2}$ fathoms water, occupies a mid-channel position between Calshot spit and the north-west side of the Bramble shoal, having a channel on either side leading to Southampton water, the one to the northward being the broader and deeper of the two.

A can buoy, with red and white horizontal stripes, in $4\frac{1}{2}$ fathoms marks the west end of the danger, and is distant three-tenths of a mile N.W. by N. of the N.W. Bramble buoy.

CALSHOT LIGHT-VESSEL, moored within the Bramble shoal in $5\frac{3}{4}$ fathoms water, S.E. $\frac{1}{3}$ S. $1\frac{1}{8}$ miles from Calshot castle, exhibits at 31 feet above the sea a white light, which *revolves* every *minute*, and should be visible in clear weather from a distance of 9 miles. The vessel is painted red, with the word Calshot on her sides; and carries a ball at the mast head. A gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger.

Hill head Buoy, conical and red, lies in 3 fathoms water, on the N.E. side of the Bramble shoal, with the N.W. Bramble buoy W. $\frac{3}{4}$ S. $1\frac{4}{10}$ miles; Calshot light-vessel N.N.W. seven-tenths of a mile; and on the line between the East Bramble buoy and Calshot castle.

SOUTHAMPTON WATER forms one of the finest harbours in the kingdom, being quite landlocked, and its approaches so protected that no

sea of any consequence can rise. From Calshot castle to the town of Southampton the deep water space embraces a channel 5 miles long and half a mile wide, between banks of soft mud which cover at high water. For $3\frac{1}{2}$ miles of this distance the channel carries 5 to 9 fathoms at low water, but at $1\frac{1}{2}$ miles below the town, in mid-channel, between Hythe and Netley abbey, is Netley shoal, with only 2 fathoms on it; there is, however, a 4-fathom channel on the western side of this shoal, and a 3-fathom channel on the eastern side; and thence to the bar, which has 2 fathoms on it, the depths are 4 to 5 fathoms. Above the bar, abreast the town, there is a narrow space about half a mile long, with 3 to $3\frac{1}{2}$ fathoms in it.

The edge of the mud bank bordering the western side of Southampton water is marked by black buoys, and that on the eastern side by red buoys. The mud bank on the western side between Calshot and Hythe is steep-to, suddenly breaking down from a high bank to 7 and 8 fathoms water. On the eastern side, at 2 miles within the light vessel, is the entrance of the river Hamble, which is navigable for small vessels for about 3 miles up to Bursledon bridge, where there are 6 feet at low water, and the rise of tide nearly the same as at Calshot point. A spit runs out nearly a mile from the north entrance point, and its extreme is marked by a red buoy; the village of Hamble is about half a mile above this point. At a mile above the village is the magnificent structure known as the Royal Victoria Military Hospital; and about a mile nearer Southampton the fine old ruin of Netley abbey.

The town of Southampton stands at the confluence of the rivers Teste and Itchen, and since the introduction of steam and railways it has become the principal foreign packet station in the kingdom. The docks are built upon a large scale on the south side of the town, and comprise a tidal basin—the entrance to which is on the west side of the Itchen—a floating dock, and 3 dry docks which open out of the basin. The tidal basin comprises an extent of 16 acres, with an entrance 150 feet wide, and carries a depth of 31 feet at high water springs, 27 feet at high water neaps, and 18 feet at low water springs. It has a quay frontage of 3,300 feet, surrounded by extensive bonded warehouses, vaults, sheds, and cellars, and is supplied with numerous cranes, and a powerful pair of sheers tested to the weight of 100 tons.

The floating dock is 10 acres in area, 770 feet in length, 550 feet in breadth, 56 feet wide at entrance, with 30 feet water in it, and 29 feet over sill at high water springs, and 25 feet at high water neaps. The dry docks are named Eastern, Western, and Middle docks; they are respectively 475, 346, and 282 feet in length; 425, 343, and 233 feet on blocks; 80, 66, and 51 feet wide between gates; and have 26, 20, and 14 feet over blocks at

high water springs, and 24, 16, and 10 feet at high water neaps. A timber pile pier extends from the centre of the town, into 2 fathoms at low water, and 4 fathoms at high water springs.

The docks are surrounded by quays measuring 5,000 and 6,000 feet. Ships can enter the docks at all times of tide for general business or for repairs. An extension of the London and South-western railway is carried into the docks, so that goods and passengers can be conveyed to London within three hours.

The breadth of the anchorage off the town is about $1\frac{3}{4}$ cables, which increases to $3\frac{1}{2}$ cables lower down, and the depth is from $2\frac{1}{2}$ to $3\frac{1}{2}$ fathoms at low water. The channel from the mouth of the Itchen to the entrance of the tidal basin is widened and deepened to 16 feet at low water springs. The channel up the river Teste above Southampton is marked by buoys and booms. A large proportion of the timber from the New Forest is exported from Redbridge, a village at the head of Southampton water, where there are several ship building yards, and a manufactory for linseed oil and cake.

LIGHTS.—Two *fixed* lights are exhibited on the dock pier heads, *dark red* on the northern pier, and *red* on the southern pier; when in one bearing N.N.E. $\frac{2}{3}$ E. they lead up the Itchen, which is buoyed and beacons on either side, to the entrance of the docks. Two *fixed* white lights, 15 yards apart, are also shown from the end of the town pier, and when in one lead through the channel.

TIDES.—There is a double high water at Southampton, the knowledge of which is most important. The first high water on full and change days is at 10h. 30m., the second high water at 12h. 45m., and low water at 4h. 0m.; springs rise 13 feet, and neaps $9\frac{1}{2}$ feet. At Marchwood magazine, springs rise 12 feet, neaps $9\frac{1}{2}$ feet. At Redbridge it is high water 12 minutes later than at Southampton, and low water at 3h., or one hour sooner; springs rise $8\frac{1}{2}$ feet, neaps 6 feet.

The double high water at Southampton is probably caused by the tide from Spithead, for as long as it runs strong to the westward, the water is kept up at Southampton, and there is no fall of consequence until the tide begins to slack at Spithead; but when the tide makes to the eastward at Spithead, the water falls rapidly at Southampton (*see* page 135).

After low water the tide rises pretty steadily for about $6\frac{1}{2}$ hours, which may be considered as the first or proper high water; it then ebbs for an hour about 9 inches, at the end of which time it again commences to rise, and in about $1\frac{1}{4}$ hours reaches its former level, and sometimes higher; this is called the second high water, being something more than 2 hours after the first. To the mariner, the knowledge that the high water remains

stationary for rather more than 2 hours may, in some cases, be very important.

The ebb continues $3\frac{1}{2}$ hours, and falls most rapidly 2 hours after the second high water, at which time the stream runs strongest in the fairway. At neaps although the tide stands for a considerable time near high water, there is no observable difference in the level.

There is a marked difference in the set of the tide, and in the time of its turning on the opposite sides of the entrance of Southampton water : for example, near Hill head on the eastern side, the eastern stream makes at 2h., and the western stream at 9h. 15m., running rather more than 7 hours one way, and 5 hours the other, as it does at Spithead ; whereas on the opposite shore the time of turning is at 3 h. 45m. and 10h. 30m.

The Bramble has a considerable influence in diverting the tide and increasing its rate. The last 2 hours of ebb, the stream splits near Calshot, one part running to the westward, and the other to the eastward, scooping out in their progress the two channels, one on each side of the shoal.

DIRECTIONS.—There are two channels leading into Southampton water, one, with 14 feet in it at low water springs, on the eastern side of the Bramble, and the other, with 5 to 10 fathoms in it, on the north-west side of that shoal ; the latter is the main channel, but it is considerably narrowed by the Thorn knoll, with only $2\frac{1}{2}$ fathoms on it, which for vessels of large draught makes it somewhat intricate. The channel eastward of the Bramble can only be used by vessels of moderate draught, except at high water, when those drawing 22 or even 23 feet may avail themselves of it.

To enter by the western channel, having arrived between the Lepe Middle and Egypt point, steer for Calshot light-vessel on an E.N.E. bearing—the light-vessel will then appear a little open south of the black refuge buoy on Calshot spit ;—after passing about 2 cables westward of the light-vessel, a N. by W. $\frac{1}{2}$ W. course will lead up to Southampton, keeping in mid-channel and leaving the black buoys on the port hand, and the red buoys on the starboard.

If entering by the eastern channel, pass 2 cables eastward of the east Bramble buoy, steering about N.W. $\frac{1}{2}$ N. for Hill Head buoy, which should be passed close to on its southern side, and when midway between it and Calshot Spit Refuge buoy, shape a course to pass 2 cables westward of the light-vessel, and proceed as before.

At Night.—Having passed through the Needles channel, the white light in the high lighthouse at Hurst kept West will lead in mid-channel up the Solent, until Calshot light beats E.N.E., which bearing must be maintained with great precision in order to pass between Thorn knoll and Calshot spit. Calshot light S. by E. $\frac{1}{2}$ E. will lead up to Southampton ; but as the

tide runs strong, it need scarcely be observed that a stranger should not attempt this navigation at night without a pilot.

The two lights on the dock pier heads kept in one, N.N.E. $\frac{3}{4}$ E., lead up the river Itchen to the entrance of the docks. The two lights on the Royal pier in one, lead up to the pier end.

Prince Consort Shoal, composed of gravel and shells, is about a cable in extent, with 22 feet on its shoalest part, which lies E. by N. $\frac{3}{4}$ N. $3\frac{1}{2}$ cables from the Club house on West Cowes point.

A red can buoy lies in 4 fathoms about 33 yards to the northward of the 22 feet patch, with Old Castle point S.E. nearly three-quarters of a mile; the Club house flagstaff W. by S. $\frac{3}{4}$ S., about 4 cables distant; and West Middle buoy E. $\frac{3}{4}$ S. $1\frac{1}{10}$ miles.

To pass northward of the shoal keep Ryde pier open of Old Castle point.

OLD CASTLE POINT.—On the eastern side of entrance to Cowes harbour is an extensive high bank of mud called the Shrape, which at Old Castle point dries upwards of half a cable from the shore; and as the water is shoal for some distance outside this, the locality is marked by a red can buoy which lies in 3 fathoms, with the Bathing house on Old Castle point, S.W. about 2 cables; Prince Consort's buoy, N.W. by W. seven-tenths of a mile; and West Middle buoy, E. by N. six-tenths of a mile. The depth is only 2 fathoms, at the distance of 130 feet within the buoy.

Ryde Middle Shoal, lying between East Cowes and Stokes bay, is a long narrow bank of mud, gravel, sand, and shells. Its western extreme is nearly three-quarters of a mile from the red buoy off Old Castle point; and thence it extends in a S.E. by E. direction for upwards of 2 miles, parallel with the Mother bank. The least water on the shoal is 2 fathoms, about two-thirds of a mile from its western end, and there are 6 fathoms near on either side.*

Each end of this bank is marked by a buoy, painted with red and white horizontal stripes. From the west (can) buoy, in 28 feet water, close to the westward of a 15-feet patch, Asheydown tower bears S. $\frac{1}{2}$ E., and the Club house at West Cowes point, W. $\frac{1}{4}$ S.

From the east (conical) buoy in 3 fathoms, Asheydown tower bears S. by W. $\frac{1}{4}$ W.; Southsea castle is on with Gilkicker point, E. by S. $\frac{1}{4}$ S.; Peel bank buoy W.S.W. three-quarters of a mile; and West Sturbridge buoy S.E. $\frac{1}{4}$ E. $2\frac{1}{8}$ miles.

Sturbridge Shoal, with 16 feet water, midway between Ryde and Gilkicker point, is narrow, composed of sand, and three-quarters of a mile

* See Admiralty Chart, Spithead and approaches from the eastward, No. 2,050; scale, $m = 2.75$ inches.

long in a S.E. $\frac{1}{2}$ E. direction. Each extreme is marked by a buoy, painted with black and white horizontal stripes.

The western (can) buoy lies in $3\frac{1}{2}$ fathoms, with Nelson's monument N.N.E. $\frac{1}{2}$ E.; No-man's land fort S.E. $\frac{1}{4}$ E.; and outer end of Ryde pier S.W. The eastern (conical) buoy lies in 19 feet water, with Spit fort E.N.E.; No-man's land fort S.E.; and outer Spit buoy East $1\frac{3}{4}$ miles.

Peel and Mother Banks, extending across the bight between East Cowes and Ryde, extend $4\frac{1}{2}$ miles in a S.E. by E. direction from Old Castle point, and terminate to the eastward in an inner and an outer spit. The Inner spit lies between Sturbridge shoal and Ryde sand, but the eastern edge of the Outer spit in 3 fathoms lies two-thirds of a mile W.N.W. from the western extremity of Sturbridge shoal, with Kickergill tower in line with the western edge of the large chalk pit on Portsdown hill, N.E.

The depths on these banks vary from $1\frac{1}{2}$ to $2\frac{1}{2}$ fathoms at low water, with 5 fathoms on their outer edge, which—abreast Wootton creek—is $1\frac{1}{4}$ miles off shore, and there are 7 to 10 fathoms between the outer and inner spits of the Motherbank and the Sturbridge.

Peel bank (can) buoy is red, and lies in 5 fathoms water, on the northern edge of the Peel bank, abreast King's Quay creek and about a mile off shore, with East Middle buoy E.N.E. five-sixths of a mile; and Ashey-down tower S. $\frac{1}{2}$ W.

THE QUARANTINE GROUND is to the N.N.W. of the town of Ryde, and its limits are marked by five buoys, the three outermost of which are a mile from the shore. The deep water is near the Lazaretto, where there are from 4 to 5 fathoms. Merchant vessels in pratique generally anchor between the Outer and Inner spits of the Mother bank, and the Sturbridge in from 5 to 11 fathoms water, over good ground, and sheltered from southerly winds, with Ryde bearing from S.W. to S.S.W.

RYDE.—From Cowes the shore trends in a south-easterly direction $7\frac{1}{2}$ miles to Nettlestone point, and is fronted by sands and shallow banks. At the distance of $1\frac{1}{2}$ miles the two lofty towers of the Royal residence at Osborne are visible above the trees, and at $5\frac{1}{2}$ miles is the town of Ryde with its old and new piers. The new pier, 800 yards long and 22 feet wide, projects in a northerly direction from the town, and at the pier head there are about 7 feet at low water springs.

The old pier runs off from the town about 200 yards eastward of the new pier and in the same direction. It is 400 yards long and 30 feet wide, with $4\frac{1}{2}$ feet at the pier end at low water. Five sets of screw moorings will be laid down on each side of the pier. On the shore between the piers is the entrance to a tidal basin, 220 feet long, 110 feet wide, with $8\frac{1}{2}$ feet in it at high water springs, and $5\frac{1}{2}$ feet at neaps. At the head

of the tidal basin is a floating basin, 250 feet long, 20 feet wide at entrance, with 8 feet over sill at high water springs, and 5 feet at neaps.

LIGHT.—A *fixed* white light, elevated 21 feet above high water, and visible at about 6 miles, is shown from the end of the old pier.

TIDES.—It is high water, full and change, at Ryde pier at 11h. 20m., and low water at 4h. 15m. ; springs rise 13 feet, and neaps 10 feet.

STOKES BAY PIER and LIGHTS.—A pier, 600 feet long and 60 feet broad, runs off from the shores of this bay, about half a mile northward of Gilkicker point. The pier-head, which is the terminus of the South-western railway, is diamond shaped, 240 feet long and 90 feet broad, and there are 6 feet alongside it at low water springs. This pier and the new pier at Ryde are in conjunction with the South-western railway.

A *red* light is shown on east and west end of the pier, and a central *red* light is also shown when a steamer is expected.

Beacon buoys for measured mile.—Two beacon buoys with staff and ball are moored off Stokes bay, for the purpose of indicating the course of the measured mile for testing the speed of Her Majesty's ships. The eastern buoy lies in 13 fathoms water, half a mile to the southward of Gilkicker point ; and the western buoy lies in 10 fathoms, three-quarters of a mile to the southward of Brown Down batteries.

The buoys lie N.W. and S.E. of each other, and are placed a cable's length from either end of the measured mile, whose limits are shown by beacons on shore. As the course between the buoys is not more than $1\frac{1}{2}$ cables outside a bank in Stokes bay, on which there are only $3\frac{3}{4}$ and 4 fathoms, ships of heavy draught should not turn inwards, or towards the shore of the bay.

DIRECTIONS.—Vessels proceeding from the Solent towards Spithead usually go south of the Ryde Middle, between it and the Mother bank. If intending to take this channel, having passed through Cowes road, and between the red buoy off Old Castle point and the west buoy of the Middle, steer so as to bring Egypt point *just* opening of Old Castle point, W.N.W. nearly, and these marks on astern will lead to the anchorage at Spithead.

There is an equally good channel north of Ryde Middle between it and the Bramble, the leading mark through being the tower or flag-staff of Southsea castle, well open north of fort Monkton, E.S.E. ; and when the east buoy of the Middle bears South, steer S.E. $\frac{1}{2}$ E. for Spithead. The former mark continued will lead to the anchorage in Stokes bay, which is often resorted to by small vessels in strong northerly winds ; vessels of large draught will pass outside the banks in this bay by keeping Calshot castle open south of Calshot light-vessel.

In proceeding westward from the anchorage at Spithead, and intending to go north of the Middle, steer about N.W. into Stokes bay until the tower or flag-staff of Southsea castle appears well open northward of fort Monkton, E.S.E. ; and with this mark on, proceed between the Middle and Bramble shoals until abreast Egypt point, when the course to Hurst is West, and the distance $9\frac{1}{2}$ miles.

If intending to go south of the Middle, steer to the westward until Egypt point is just open of Old Castle point bearing W.N.W. nearly ; taking care, however, when nearing the east buoy of the Middle not to keep Egypt point too much open of Old Castle point, for fear of getting too near that shoal. When the west buoy of the Middle bears about N.N.W. steer N.W., or more northerly, to avoid the ledge off Old Castle point, till Egypt point bears W. $\frac{3}{4}$ N., and then steer W.N.W. till abreast it.

A vessel of large draught turning to windward to the northward of the Middle may stand towards the Sturbridge shoal and Gilkicker point to 10 fathoms at low water, the Mother bank to 7 fathoms, Stokes bay to 9 or 8 fathoms, the Middle to 7 fathoms, and towards the shore to the same depth ; but no nearer the Bramble than 9 fathoms, nor Old Castle or Egypt point than 8 fathoms. Working to the southward of the Middle, stand no nearer the Mother and Middle banks than the depth of 7 fathoms. Between Egypt point and Yarmouth, the island may be approached to 8 or 7 fathoms, and the main to 7 or 6 fathoms.

SOUTH COAST OF ISLE OF WIGHT.

ASPECT of COAST.—St. Catherine point bears S.E. $\frac{1}{4}$ S. $12\frac{1}{2}$ miles from the Needles, the land gradually ascending to the point and beyond it as far as Dunnose, the south-east point of the island, above which St. Boniface down rises 770 feet above the level of high water springs ; and thence it declines towards Culver cliff, the eastern end of which, being of chalk, may be easily recognized from the marked contrast between it and the land in its vicinity. From the pitch of this cliff, 213 feet high, the land gradually rises to the crest of Bembridge down, on which stands a fort. Yarborough monument, a conspicuous object from seaward, stands on Culver Down, 312 feet above high water.

From Culver cliff the land gradually decreases in height, until it terminates in Bembridge point, which is low. Midway between the cliff and the point is a place called Black rock, where the coast-guard watchhouse, a conspicuous white cottage, stands on the edge of the bank 89 feet above high water. As Bembridge point is approached, Foreland farm will be observed, which is a useful and well known sea-mark.

FRESHWATER BAY.—From the Needles the range of high and precipitous chalk cliffs continue on to the middle of Freshwater bay, where they are lower, and about $1\frac{1}{2}$ miles beyond merge into a shore of clay and sand. On the highest part of the cliffs, 490 feet above high water, is Nodes beacon. Freshwater bay is between the Needles and Brook point, and on its shore, at the head of a small cove about 3 miles from the Needles, is a watering place named Freshwater Gate. On the west side of the cove is a small fort cut out of the chalk cliff.

Brook and Atherfield Ledges.—Off Brook point are the remains of fossil trees, and to the eastward a small cove and landing place off the chine, near which is Brook village. Steep clay cliffs of moderate and nearly equal height extend from Brook to beyond Atherfield point, and there are several beautiful chines and villages, at the back of which are high and extensive downs. About $1\frac{1}{2}$ miles from St. Catherine point the land begins to rise; and a mile westward of the point is Blackgang chine, between which and Atherfield point is Chale bay, the scene of so many fatal wrecks.

The whole of this part of the coast is fronted by dangerous ledges, which in some places extend nearly a mile from the shore. The principal are Brook and Atherfield ledges; but there are also sunken rocks, of which St. Andrew and Chale rocks are the most off-lying. This part of the coast should be most cautiously approached, especially in thick weather and during the flood, as that stream sets directly towards them (*see* page 134).

Landing Places.—There is a landing place at Chilton chine, and on each side of Atherfield point; and there is another at Puckaster cove, about a mile eastward of St. Catherine point.

Life Boats.—A life boat is established at Brook and Brixton chines, between Freshwater bay and St. Catherine point.

ST. CATHERINE POINT, the southern extremity of the Isle of Wight, is a low rounded point at the foot of St. Catherine hill, and the stone lighthouse marking the point, stands out boldly when viewed from eastward or westward. The hill, which is the highest part of the island, rises to the height of 804 feet above high water, about a mile northward of the point, and on its summit are the remains of the old lighthouse, and an old tower.

A low cliff extends along the shore between St. Catherine point and Dunnose, and at its back are large masses of rock called the Undercliff, which is again backed by a wall of precipitous rock nearly 500 feet above the sea, with downs rising still higher behind. Steep-hill castle, with the villas and church at Ventnor, are conspicuous objects when sailing along this part of the coast, which may be approached to half a mile, as the rocks bordering it do not extend off above half that distance.

Close to the westward of St. Catherine point, between it and Rocken End, is a rocky ledge with 3 to 6 fathoms on it, which extends more than half a mile from the coast, and close to the shore are the Jeremy and Shag rocks. At $1\frac{1}{2}$ miles W. $\frac{1}{4}$ N. from St. Catherine point is a rocky patch of 9 fathoms, with deep water around it.

To the eastward of St. Catherine point is St. Catherine deep, with 37 and 39 fathoms water, rocky bottom, which extends parallel with and about a mile from the shore abreast the Undercliff. It is several miles long and from half a mile to a mile broad, with a general depth outside of 11 and 12 fathoms, rocky bottom. Near its east end, and more than 4 miles S.E. $\frac{1}{2}$ S. from Dunnose is a rocky patch of 10 fathoms with 25 to 35 fathoms between it and the land.

ST. CATHERINE LIGHT.—The lighthouse on St. Catherine point is an octagonal stone castellated building 122 feet high, and from it at an elevation of 178 feet above high water is exhibited a *fixed* white light of the first order, which should be visible in clear weather from a distance of 19 miles.

Fog Horn.—In foggy weather a powerful Fog horn will be sounded from St. Catherine's lighthouse. The mouth of the horn is at an elevation of 81 feet above high water, and will traverse an arc of 215 degrees, viz., from E. $\frac{3}{4}$ S. round by South to N.W., and will point in every direction between those bearings once in each minute; the duration of the sound being *five seconds*, with an interval of *fifteen seconds* between each blast.

SANDOWN BAY.—Between Dunnose and Culver cliff is Sandown bay, in which are the villages of Shanklin and Sandown. The steep cliffs continue on from Dunnose towards Sandown, where they decrease in height, and the shore is low and sandy; they then gradually rise to Culver cliff, close to the westward of which is a cliff of red clay, which contrasts strongly with the chalk of Culver cliff.

The water is shallow for some distance off the shore of Sandown bay; but the lead will be a good guide when standing in. There is a rocky patch of 9 fathoms at 3 miles, and another of $9\frac{1}{2}$ and 10 fathoms at $4\frac{1}{2}$ miles E. by S. from Dunnose.

WHITE CLIFF BAY.—Culver spit, carrying $4\frac{1}{2}$ fathoms water over rocky bottom, extends nearly $1\frac{1}{2}$ miles south-east from Culver cliff, and within it, close to the eastward of the cliff, is White Cliff bay, where a limited extent of clear ground affords tolerable shelter out of the stream, with the wind off-shore, for small vessels waiting tide. The east pitch of the cliff W. $\frac{3}{4}$ N., and the coast-guard watch-house N. by E. will place a vessel half a mile off-shore in $2\frac{1}{2}$ fathoms water. A small reef, the outer

part of which dries at low tide, extends nearly one-eighth of a mile from the base of Culver cliff; and a large rock, called the Shag, which covers only at high water springs, lies at the point of the cliff.

White cliff bay terminates at Black rock, and thence to Bembridge point the coast is fringed by one unbroken rocky shelf, uncovering at low water to the extent of nearly a third of a mile from the shore. These rocks are high and steep to at their outer edge, and over many parts there are not more than 3 or 4 feet at high water springs; outside their edge the depth increases to 2 fathoms, which depth will be found throughout at the distance of half a cable's length. Within their margin, just inside the point called Sharpus, on a small sandy patch which dries at low water, the fishermen find a valuable shelter for their small boats during the fishing season.

TIDAL STREAMS.—At Atherfield point it is high water, full and change, at 10h. 20m. and low water at 3h. 40m.; springs rise $8\frac{1}{2}$ feet, and neaps 7 feet. In Freshwater bay, about one mile S.W. of Brook point, and the same distance off Atherfield point, the western stream makes at 10h. 25m., and runs at the rate of one knot, and the eastern stream at 2h. 35m., from 2 to $2\frac{3}{4}$ knots; both streams take the direction of the coast. About $4\frac{1}{2}$ miles W. by S. from St. Catherine point, the western stream makes at 11h. 0m., setting N.W. $\frac{3}{4}$ W., and the eastern stream at 5h. 0m., in the opposite direction, the rate of both being from 2 to 4 knots; but one mile W. by S. from the point the streams set N.W. by N. and S.E. by S., 3 to 4 knots, and two-thirds of a mile S.S.W. of the point, W. by N. and E. by S. with the same velocity.

After rounding St. Catherine point the seaman must be on his guard at night against the indraught on the flood, which will be found more or less when navigating between the Isle of Wight and the Owers.

Nearly 5 miles S.S.E. of Dunnose, at full and change, the streams turn at 10h. 40m. and 4h. 30m., and set E. $\frac{1}{2}$ S. and W. by N.; velocity, from 4 to 5 knots at springs, and 3 knots at neaps; but S.E., 2 miles from Dunnose, the flood sets E. by N., and the ebb W. by S., and the turn of both streams is rather earlier. At one mile S.E. of Dunnose, the flood sets N.E. by E., or towards the Princessa shoal.

DIRECTIONS.—Between the Needles and St. Catherine point the shore must be approached with caution, particularly on the flood, as that stream sets directly towards the many treacherous ledges stretching out a considerable distance, particularly those off Brook and Atherfield points. The highest of the chalk cliffs on the east side of Freshwater bay on with Brook point N.N.W., or a remarkable white road running over the down in line with Blackwood point, (View P) will lead outside the Ship and Atherfield ledges, and also of the St. Andrew and Chale rocks to the south-east. A safe mark for small vessels working up in-shore is, to keep

the three Needles rocks open of Sun Corner, or the Priory church at Christchurch open of the Needles lighthouse, N.W. by N.; with the Needles lighthouse only open of Sun Corner, a vessel would run upon the Atherfield ledges. At night a vessel of large draught should on no account lose sight of the Needles red light, which will be on a N.W. $\frac{1}{2}$ N. bearing, nor stand into a less depth than 15 or 16 fathoms at low water.

A good precaution is to keep the Needles light N.W. by N. until St. Catherine light bears N.E., when a vessel may safely haul to the eastward until the Nab light is sighted, the bearing of which will be a guide for clearing the Princessa shoal and for the eastern entrance to Spithead, (*see* page 177).

The overfalls off St. Catherine point and Dunnose are partly caused by the various sudden transitions from deep to shoal water in that neighbourhood; but they are not dangerous, except in bad weather, when no open boats should attempt to pass through either. The race off St. Catherine point varies in proportion as the wind is with, or against the tide. In gales from the westward, and during spring-tides, the sea breaks to the south-east of the point as violently as in the race of Portland.

EASTERN ENTRANCE TO SPITHEAD.

The eastern passage into Spithead is between the Dean and Horse sands, and the several shoals which lie off the eastern end of the Isle of Wight. The principal dangers on the island side are the Princessa, Bembridge, Nab, Warner, No-mans Land, &c.

Princessa shoal is an extensive and irregular patch of foul ground, the middle of which bears from Culver cliff E.S.E., about 2 miles. The shoal is nearly $1\frac{1}{2}$ miles long E. by S. and W. by N., and near its western end rather more than half a mile broad. The water over it varies from $3\frac{1}{2}$ to 5 fathoms, the shallowest part being near the north-western edge, where there is a ridge a quarter of a mile in length, East and West, with as little as 19 feet over it at low water; but as there are several shoal heads of 22 to 24 feet on the shoal, vessels of large draught should be cautious how they cross any part of it.

The Princessa is marked by two buoys: the N.W. or inner buoy can shaped, and painted with black and white vertical stripes, lies in 32 feet close to the north-western edge of the shoal, and from it Culver cliff bears W. by N.; Nettlesome and Bembridge points in line N. by W. $\frac{1}{2}$ W.; and Bembridge ledge buoy N.N.E. nearly a mile.

The S.E. buoy, conical with staff and cage, is chequered black and white, and lies in 29 feet water, on the south-eastern edge of the

shoal, with the red clay cliff in Sandown bay just open of Culver cliff W. by N. $\frac{1}{2}$ N. ; Foreland village N.W. $\frac{1}{2}$ N. ; N.W. Princessa buoy N.W. $\frac{1}{2}$ W. eight-tenths of a mile ; and Nab light-vessel N.E. $\frac{1}{2}$ E. $2\frac{4}{10}$ miles.

The northern sharp shoulder of Appuldercomb hill in line with Shanklin railway station, W. $\frac{1}{4}$ N. (View Q) leads south of the Princessa ; the spire of Bembridge church on with Foreland farm N.W. (View R), leads north ; and Bembridge fort its apparent breadth inside Nettlestone point N.N.W. $\frac{1}{4}$ W. clears the eastern side. The red clay cliff in Sandown bay kept open south of Culver cliff, W.N.W., will also lead south of the shoal ; and it will be avoided at night or in thick weather by not standing into less than 10 fathoms at low water.*

Bembridge Ledge, extending three-quarters of a mile off Bembridge point, has only 18 feet over its outer edge. A considerable part of this ledge dries at half tide, and terminates in a high sharp point named Sharpus, about a third of a mile off shore, in a S.E. by E. direction, rather more southerly than the main body of the shoal : there are not more than 5 feet over its outer extremity, even at high water springs.

A chequered black and white (can) buoy marks the outer edge of Bembridge ledge in 4 fathoms, with Bembridge church, N.W. by W. $\frac{1}{2}$ W. ; centre of Horse fort on with centre of Southwick fort on Portsdown hill, N. $\frac{3}{4}$ E. ; Warner light-vessel N. $\frac{3}{4}$ E. $2\frac{7}{10}$ miles ; and Nab light-vessel E. $\frac{3}{4}$ N. $2\frac{1}{2}$ miles.

Bembridge mill on with the highest part of Brading down, W. by N. $\frac{3}{4}$ N. ; and the Dock mill at Southsea, on with the large chalk-pit on Portsdown hill, N. by E., will serve as close marks for the edge of the shoal in 4 fathoms should the buoy be removed.

A Life Boat is stationed at Bembridge.

Cole Rock and Dawe Banks are two dangerous patches on the northern part of Bembridge ledge, which small vessels should approach with great caution. The north-western patch, Cole rock, shows itself at spring tides, and dries in several heads in a N.W. and S.E. direction for more than a cable. From the centre of the rock, St. Helens church is just open south of St. Helens Sea Mark—a stone structure erected on the shore a quarter of a mile S.S.W. of St. Helens point—bearing N.W., and the face of Culver cliff is just within Bembridge point between Foreland farm and Foreland village, S.W. by W. $\frac{1}{2}$ W.

The south-eastern patches, the Dawe banks, form an irregular shaped shoal about a third of the distance from the Cole rock to Bembridge ledge buoy. It never dries, but there are not more than 8 feet water over its shoalest part.

* See Views on Admiralty Chart ; Owers to Christchurch, No. 2,045 ; scale, $\pi = 1\cdot4$ inches.

St. Helens church open a quarter of a point northward of the Sea Mark, N.W. $\frac{1}{4}$ W., leads north of both patches; and Black rock watch-house in line with north end of chalk pit on Culver Down, W. $\frac{3}{4}$ S., leads to the southward. These will be found useful marks for small vessels; for although the latter may be considered as leading full close, they may by not exceeding it be sure of carrying a depth of 2 fathoms at low water. When northward of Cole rock, or when Culver cliff is well open north of Foreland farm, St. Helens church should be opened more of the Sea Mark, to insure clearing the tail of the shoal, which extends some distance northward of the rock.

Nab Rock.—Although the water deepens suddenly into 6 or 7 fathoms to the eastward of Bembridge ledge, the rocks soon rise again and extend off a considerable distance under the general name of the Nab shoal, the body of which is about a mile long N.W. and S.E., and a quarter of a mile broad, with numerous shoal spots of 25 to 27 feet water.

The small head, known as Nab rock, near the centre of the shoal, has only 23 feet over it at low water, and is marked on its south-east side by a can buoy, with black and white horizontal bands, in $4\frac{1}{2}$ fathoms, with Ashey Down tower in line with boat house, at Lane End, W. by N. $\frac{1}{2}$ N.; east end of Eastney barracks in line with east end of Widley fort on Portsdown hill, N. by E.; Bembridge ledge buoy, W. $\frac{1}{2}$ S. eight-tenths of a mile; Warner light-vessel N. by W. $2\frac{3}{4}$ miles; Nab light-vessel E. by N. $1\frac{1}{2}$ miles; and Princessa S.E. buoy S. by W. $\frac{3}{4}$ W. $1\frac{1}{2}$ miles.

NAB LIGHT-VESSEL, moored in $5\frac{1}{2}$ fathoms water, exhibits two *fixed* white lights on masts 18 yards apart; the light on the mainmast is 38 feet, and that on the foremast 28 feet above the sea, and they should be visible in clear weather from the respective distances of 8 and 6 miles. The vessel is painted red, with the word Nab on her sides, and carries a ball at each mast head; a gun is fired if a vessel is seen standing into danger, and a gong sounded in foggy weather.

The marks for the vessel are Portsmouth church tower in line with Southsea castle lighthouse N. by W. $\frac{1}{2}$ W.; Kickergill tower in line with east end of fort Monkton N.N.W. $\frac{1}{2}$ W.; North tower of Osborne just open of easternmost trees near Ryde N.W. $\frac{3}{4}$ W.; Warner light-vessel N.W. $\frac{1}{2}$ N. a little over 3 miles; and Dean Tail buoy N.E. $\frac{3}{4}$ N. $1\frac{1}{4}$ miles.*

* **TEMPORARY LIGHT-VESSEL.**—A vessel showing a *fixed* white mast-head light is moored 40 fathoms S.S.E. of the wreck of an iron screw-steamer in the fairway of the eastern channel into Spithead. From the temporary light-vessel, the Nab light-vessel bears S.E. $\frac{1}{2}$ S. $1\frac{1}{2}$ miles; and the Warner light-vessel N.W. $\frac{1}{2}$ N., $1\frac{3}{4}$ miles.

Buoy.—A wreck buoy (green) has been placed about 20 fathoms on the north-west side of the wreck, which lies across the channel in about a N.E. and S.W. direction (October 1868).

Outer Nab Shoal is a small patch of foul ground $\frac{1}{2}$ mile $\frac{1}{2}$ W. $\frac{1}{2}$ S. from the Nab light-vessel, and in these are only $\frac{1}{2}$ fathoms in its shallowest part. It should be avoided by vessels of large draught. Bembridge mill in with the north-east end of Freshwater village, N.W. by W. $\frac{1}{2}$ W. points in line by fathoms; we are with the north-west end of the village N.W. by W. made in the westward of the patch; whilst Bembridge church in with Lane End farm S.W. by W. $\frac{1}{2}$ W. made in the northward. The barracks in the main-gate houses in the rear of the bank at Sandown, in line with Crown Hill W. $\frac{1}{2}$ S., made well in the northward, and also midway between it and the Nab shoal where the depths are 5 and 6 fathoms.

New Grounds are several shoal spots of gravel, sand, and broken shells lying within the Nab light-vessel in the westward, and which have possibly been brought up by the hydraulic tide meeting the tide round Dunnoe somewhere near this spot.

The **New Grounds** are dangerous for vessels of heavy draught after half ebb, with any sea on, as there is as little as $4\frac{1}{2}$ fathoms over the shallowest part, which lies W. by N. $\frac{1}{2}$ N. a little over a mile from the Nab light-vessel. As the ground in this locality is very irregular, with many patches of 5 fathoms and less, it would be advisable to bear in mind when piloting large ships, that all these detached patches are comprised within the following limits, viz., The northern sharp shoulder of Appulderecomb hill in line with Shanklin railway-station, W. $\frac{1}{2}$ N.; and the Nab light-vessel N. by E. $\frac{1}{2}$ E.

Long Rock is the name given to a considerable extent of foul ground lying to the north-west of the Nab shoal, and on which there are several heads of 23 to 25 feet water. On the shoalest head of 23 feet, Culver cliff is seen nearly half a point open northward of Lane End farm; and the south-east end of St. Helens water-mill—a white building on the north side of Brading haven—is in line with the north end of the Ferry house, which stands on the shingle point on the same side at the entrance.

ST. HELENS ROAD, off the east end of the Isle of Wight, is well sheltered from all but south-east winds, with excellent holding ground of mud and stiff blue clay, and calculated for vessels of any draught. The best position for heavy ships is in 7 or 8 fathoms, with Ashey Down tower in line with Bembridge fort W. $\frac{1}{2}$ N., or St. Helens sea mark just open, to the southward of Bembridge fort; and the spire of St. Jude's church, Mouthorn, just open west of Horse fort N. $\frac{1}{2}$ E.; but smaller vessels may anchor further in with the former marks on, according to draught of water.

DIRECTIONS.—For ships of moderate draught there is a clear and safe channel, half a mile wide, between the N.W. buoy of the Princess and

the shore, and between the Bembridge ledge and Nab rock buoys, which may prove useful in fine weather and with leading winds to vessels intending to anchor in St. Helens road; but under no circumstances should ships attempt to work through, for no good turning marks can be given, and as the tides are strong, if caught with light and baffling winds near Bembridge ledge, they would be in some danger, particularly as the western stream, when free from the influence of the channel, has a strong tendency to set over that shoal.

As from the offing, the saving of distance by this channel to St. Helens road would scarcely be appreciable, it is not recommended save in cases of necessity, more especially as the course through the channel inside the Princessa is dependent on a single bearing of the Nab light-vessel; and as her position may possibly be affected by heavy gales, ships might unconsciously be led into danger.

In the event, however, of circumstances rendering such a step advisable, bring the Nab light-vessel E. by N. $\frac{3}{4}$ N., which will lead over Culver spit in $4\frac{1}{2}$ fathoms, and through the channel in from 5 to 6 fathoms, and when St. Jude's church, Southsea, just opens east of Horse fort N. $\frac{1}{4}$ E. steer for these objects, or for the Warner light-vessel bearing North; either of these should lead through in about mid-channel between Bembridge ledge and the Nab rock, the least water to be crossed being $4\frac{1}{2}$ fathoms. When Ashey Down tower comes in line with Bembridge fort W. $\frac{1}{3}$ N., or St. Helens sea mark is just open to the southward of the fort, a vessel may anchor in St. Helens road as already directed, or proceed on for Spithead, rounding the Warner light-vessel on her eastern side, and then with the leading marks on, viz., Kickergill tower in line with the centre of fort Monkton N.N.W. $\frac{1}{4}$ W., select a convenient anchorage.

This channel should not be attempted at night; but if circumstances render such a step unavoidable, bring the Nab lights E. by N. $\frac{3}{4}$ N., and steer for them on that bearing, until the Warner light bears North, when steer for her, and either anchor in St. Helens road when the *green* light on Bembridge fort bears W. $\frac{1}{3}$ N., or proceed on for Spithead, rounding the Warner light-vessel on its eastern side.

Vessels of heavy draught intending to anchor in St. Helens road, after rounding the Nab light-vessel at a moderate distance on her eastern side, should steer for Horse fort, until Bembridge fort bears W. by N. $\frac{1}{2}$ N., and then alter course to W.N.W., making allowance for tide; by following the above directions a depth of not less than 5 fathoms at low water will be preserved, and anchorage can be effected in 7 or 8 fathoms, as previously directed.

Vessels of large draught beating into St. Helens road, should not stand

farther southward than to have Foreland farm on with the eastern chalk-pits on Bembridge down, which clears the Nab shoal and New grounds; nor farther northward than to have the summit of Brading down in line with St. Helens Sea mark, which clears St. Helens patch.

When turning in to the road at night, and having the Nab lights to the southward of E. $\frac{1}{2}$ S., a vessel should, when standing to the eastward, go about as soon as the Warner light bears N.W. by W., which will be a sufficient warning of her approach to the Dean Tail. In standing to the westward, the Warner light N. $\frac{1}{2}$ E. is quite far enough.

BRADING HAVEN offers no refuge except for vessels of small draught, although at high water springs it assumes rather an imposing appearance. From the shingle points at the entrance the sands dry at the lowest tides to a considerable distance out. The bank on the south side of entrance is of sand and gravel, and extends nearly three-quarters of a mile in a north-easterly direction; its highest part, which is near the edge of the channel, has only 6 feet over it at high water, and is marked by five fragile beacons to the left on the port hand in entering; the outer beacon, which is abreast the bar, is surmounted by a basket. The bank on the northern side, from the base of St. Helens Sea mark, uncovers for about half a mile, and is thickly interspersed with large stones and masses of rock; on the outer end is a small beacon buoy, which must be left on the starboard hand in entering.

Abreast the outer beacon is a bar of sand, gravel, and stones, which dries across, the water leaving it half an hour before the tide has ceased falling by the shore, being about a foot above the low-water level; 12 or 13 feet may, however, be carried over it at high-water springs. The channel is very narrow, and not even navigable for boats at low tide. Within the high water points a few small vessels of 5 or 6 feet draught may lie afloat in a small hole on the southern side. When the tide is out the Haven is little more than an extensive bank of bare mud, with a few patches of sand and gravel, carrying a depth over most of them of not more than 3 or 4 feet at high-water springs, and remaining uncovered at neaps.

BEMBRIDGE FORT and LIGHT.—At the north-east extremity of the bank extending off the south point of Brading haven is Bembridge fort, in course of erection; the fort is about 50 yards in diameter, and from the scaffolding on its north-east side, at an elevation of 38 feet, is exhibited a *fixed green light*.

TIDES.—A narrow intricate channel leads up to Brading quay, at the head of the Haven, where the rise at Springs is only 9 feet. It is high water at the quay nearly at the same time as outside, but it does not commence rising for $2\frac{1}{2}$ hours after the flood has made at the entrance.

Near the bar it is high water, full and change, at 11h. and low water at 5h. ; springs rise 14 feet, and neaps $10\frac{1}{2}$ feet.

St. Helens Patch.—The channel into Spithead is bounded to the south-west by St. Helens patch, the Warner and No-mans Land banks, and Ryde sand ; and by the Dean and Horse sands to the north-east.

The southern shoals commence near Brading haven, where a bank extends E.N.E. $1\frac{1}{2}$ miles from St. Helens Sea mark, at which distance there are about $4\frac{1}{2}$ fathoms at low water, rapidly falling into 10 and 11 fathoms. A small bank of gravel and stones called St. Helens patch with only 17 feet over it, and 21 and 22 feet on its western side, lies about half a mile within the edge of the bank, with Ryde church just shut in with Nettlestone point N.W. $\frac{1}{2}$ W., and the coast-guard mast on the southern side of Brading haven in line with the eastern chalk-pit on Bembridge down S.W. $\frac{1}{4}$ S.

St. Helens Sea mark in line with the summit of Brading down W. $\frac{3}{4}$ S., leads to the southward of the patch ; and Ryde church open of Nettlestone point N.W. $\frac{3}{4}$ W. to the northward. Large ships working up for the Warner should not stand towards it into less than 10 fathoms water.

WARNER SHOAL, and LIGHT-VESSEL.—Warner shoal, composed of hard sand and gravel, with shells, is 2 cables long, N.N.E. and S.S.W., half a cable broad, and has only 16 feet over its shoalest part. It forms the south-east—and No-mans Land the north-west—end of the edge of the bank off Nettlestone point, which contributes in an important degree to shelter Spithead in southerly gales. The north-eastern side of the shoal is steep-to, the water deepening from 17 feet to 11 fathoms, about 60 yards from its edge. St. Helens patch bears from it S.W. $\frac{1}{4}$ W. one mile, and Nettlestone point W. $\frac{3}{4}$ N. rather more than $1\frac{1}{2}$ miles.

The light-vessel, moored in 13 fathoms water, on the eastern side of the bank, exhibits at 38 feet above the sea a white light, which *revolves* every *minute*, and is visible in all directions from a distance of 8 miles. The vessel is painted red, has the word Warner on her sides, and carries a ball at her mast-head. A gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger.

The vessel lies on the south-west side of the narrow channel separating the Warner from the Horse sand with the following marks :—St. Helens water-mill half its breadth open of St. Helens Sea mark, S.W. by W. $\frac{1}{4}$ W. ; outer end of Ryde pier seen between the towers of Osborne, N.W. by W. $\frac{1}{4}$ W. ; No-mans Land fort N.W. $\frac{1}{2}$ N. $1\frac{1}{2}$ miles ; Horse fort N. by E. $1\frac{1}{2}$ miles ; Horse Elbow buoy N.E. by N. two-thirds of a mile ; and Dean Tail buoy S.E. by E. $\frac{1}{2}$ E. 3 miles.

NO-MANS LAND BANK, FORT and LIGHT.—No-mans land bank is of much greater extent, and more dangerous than the Warner, as it has

only 7 or 8 feet water near its eastern end, with an average depth of 9 feet over every part of it at low water springs. Its eastern edge is steep-to, the lead dropping suddenly from 8 or 9 feet into 16 fathoms, and unlike the Warner there is no practicable channel between it and the island, at low water, save for the smallest description of vessels. The surface of the bank is principally gravel and shells, but so hard as to render it dangerous for vessels grounding upon it; between the bank and the island the character of the ground changes to mud and weed.

Near the eastern extremity of this bank a fort about 70 yards in diameter, is in course of erection, and from it at an elevation of 38 feet above high water, is exhibited a *fixed red* light. Ships should not approach the fort within 2 cables.

RYDE SAND.—From Nettlestone point the sands uncover at low water springs for nearly $1\frac{1}{2}$ miles in a northerly direction to the Sand-head, and thence turn away W.N.W. towards the outer end of Ryde pier.

A chequered black and white (can) buoy is placed off the Sand-head in 28 feet, with Kickergill tower in line with the centre of the new fort on Gilkicker point N. $\frac{1}{4}$ E.; outer end of Ryde pier, in line with flagstaff on Wooton point, W. by N.; East Sturbridge buoy, N. by W. $\frac{1}{4}$ W. half a mile; and No-mans Land fort, S.E. by E. $\frac{1}{4}$ E. $1\frac{1}{4}$ miles.

The approach to this extensive flat, called Ryde sand, should be made with caution, as its outer edge is steep-to, and although vessels may safely stand towards it into 10 fathoms water, they must on no account pass to the southward of the buoy. Quarr house in line with the end of Ryde pier, W. $\frac{1}{2}$ N., just clears the northern edge of the sand.

HORSE and DEAN SAND.—This extensive shoal, to the existence of which the invaluable roadstead of Spithead is mainly indebted for shelter from the violent effects of S.E. gales, is composed of coarse sand mixed with gravel and broken shells. It is quite a flat, having but little water over any part of it; from 6 to 9 feet may be taken as an average depth over the shoalest parts, and were it not for the four black buoys and fort, which mark its outer edge, it would be dangerous to approach; but in day-light with anything like clear weather, it is impossible to err with the most ordinary attention, although it is necessary to bear in mind that the outer edge in some parts is steep-to, particularly between Horse fort, and Horse Elbow buoys.

From Southsea castle, marking the eastern side of the entrance to Portsmouth harbour, the Horse and Dean commences, its direction being about S. by W. for nearly 2 miles, where the Horse fort is in course of erection near the edge of the bank, which is here very steep.

From the Horse fort the shoal trends rather abruptly to the S.S.E. and

at the distance of nearly three-quarters of a mile is Horse Elbow buoy, which with the Warner light-vessel marks the narrowest part of the channel into Spithead. Here also the bank is steep-to, the buoy lying in 5 fathoms water within a cable's length of the depth of 10 fathoms.

From the Horse Elbow buoy the shoal alters its direction to about S.E., and continues straight for two miles when it gradually disappears. This part of the bank is known as the Horse Tail, and the three buoys which mark its edge are called the Dean buoys.

HORSE FORT LIGHT.—The fort already alluded to as marking the steep north-west Ledge of the Horse sand, is distant rather more than a mile from No-mans land fort on the opposite side of the channel, and both are serviceable in marking its limits. From the Horse fort at an elevation of 34 feet above high water, is exhibited a *fixed* white light.

Dean Tail Buoy, conical and black with staff and ball, is the south-easternmost buoy on this side of the channel, and lies in 5 fathoms water, just outside the depth of 4 fathoms, with Ashey Down tower in line with St. Helens Sea mark, W. $\frac{1}{3}$ N. ; the east end of Block-House fort just open west of Southsea Castle point, N.N.W. $\frac{1}{2}$ W. ; the Nab light-vessel S.W. $\frac{3}{4}$ S., $1\frac{1}{4}$ miles ; the Warner light-vessel N.W. by W. $\frac{1}{2}$ W. 3 miles, and Dean Elbow buoy N.W. $\frac{3}{4}$ W. $1\frac{1}{4}$ miles.

Dean Elbow Buoy, can and black, lies in 5 fathoms, with south side of No-mans land fort, in line with Old Castle point, N.W. by W. $\frac{1}{3}$ W. ; the Water tower at Eastney barracks in line with east-end of Southwick fort on Portsdown hill N. $\frac{1}{4}$ W. ; Nab light-vessel S. $\frac{3}{4}$ E. $1\frac{7}{10}$ miles, and Dean buoy N.W. $\frac{1}{3}$ W. $1\frac{1}{4}$ miles.

Dean Buoy, can and black, lies in 6 fathoms about a cable from the edge of the shoal, with the Water tower at Eastney barracks in line with west end of Southwick fort on Portsdown hill N. by E. $\frac{1}{4}$ E. ; Upton mill, near Ryde, on with the upper corner of a triangular field near Nettlesome point, W. $\frac{1}{3}$ N. ; Warner light-vessel W. $\frac{3}{4}$ S. ; and Horse Elbow buoy N.W. $\frac{1}{4}$ N. six-tenths of a mile.

Horse Elbow Buoy, can and black, is in 5 fathoms water, with Kickergill tower in line with the north-east end of fort Monckton N.N.W. $\frac{1}{2}$ W.

Ashey Down tower, just open south of the houses on Nettlesome point, W. by S. $\frac{1}{4}$ S. ; Warner light-vessel S.S.W. $\frac{3}{4}$ W., eight-tenths of a mile ; and Horse fort N. by W., two-thirds of a mile.

Outer Spit Buoy marks the outer end of the spit extending in a general S.S.E. direction from the shore between Block-House and Gilkicker points, and forming the western boundary of the channel into Portsmouth harbour. The buoy, conical, and chequered black and white, lies in $3\frac{1}{2}$ fathoms, with the eastern side of No-mans land fort, in line with Yarborough monument on Culver down S.S.W. $\frac{1}{4}$ W. ; Fort Monckton mast in line with tower

of Bay house N.W. $\frac{1}{2}$ N. ; Spit refuge buoy N. by E. $\frac{3}{4}$ E. half a mile ; Gilkicker point N.W. $\frac{1}{2}$ W. ; and Horse fort S.S.E. $\frac{1}{2}$ E. one mile.

Spit Refuge Buoy, with bell, is chequered black and white and lies in 22 feet water at the extremity of the Spit sand, with east Swatchway beacon, half-way between St. Paul's church, and the west end of large chalk-pit on Portsdown hill N. by E. $\frac{1}{2}$ E. ; Gilkicker point N.W. by W. $\frac{1}{2}$ W.

There is about the same depth of water, viz., from 20 to 23 feet, over the bank between this buoy and the Outer Spit buoy, but ships of heavy draught, on entering or leaving Portsmouth harbour, should, unless near high water, pass to the southward and eastward of the Outer Spit buoy.

Boyne Buoy, nun and green, lies near the wreck of the *Boyne* in 30 feet water, and serves to mark the western edge of the Horse sand. From it the east Swatchway beacon appears half-way between St. Johns chapel and the east end of the trees on Portsmouth lines, N. $\frac{1}{4}$ E. ; and the Dock mill is in line with the London road over Portsdown Hill, N.E. by N. The buoy should always be passed on its western side. There is only 19 feet water on the wreck.

ANCHORAGE.—The limits of the best anchorage at Spithead are, Southsea castle from N.E. to E. by N., and Gilkicker point from N.N.W. to N.W. A good berth for large ships is in from 10 to 12 fathoms water, with Kickergill tower on with the red and white mile mark on the western end of fort Monkton N. by W. $\frac{3}{4}$ W. ; and the lighthouse on Southsea castle on with north end of Spit fort N.E. by E. $\frac{1}{2}$ E. ; but vessels of moderate draught may berth themselves nearer the Spit sand, in about 7 fathoms, taking care not to open Kickergill tower to the eastward of the east end of Fort Monkton barracks.

DIRECTIONS from the WESTWARD.—From about a mile off Dunnose to the same distance south of the S.E. Princessa buoy the course and distance will be E. by N. $\frac{1}{4}$ N. $6\frac{3}{4}$ miles, varying according to the direction of the wind and set of the tide. The Princessa will be avoided by keeping the red clay cliff, next westward of Culver cliff, open to the southward of the latter ; or the sharp northern shoulder of Appuldercomb hill in line with Shanklin Railway station, W. $\frac{1}{3}$ N., until abreast of the S.E. buoy of Princessa.

About half a mile outside the Princessa depths of 7 to 8 fathoms at low water will be maintained, the nature of the bottom being changeable, but generally gravel and broken shells, interspersed with numerous patches of foul ground. Nearly abreast the Nab, and thence to the New Grounds, less water may be expected, and even an occasional cast of as little as 5 fathoms, but almost invariably gravel and broken shells.

After rounding the S.E. Princessa buoy, the vessel, if of moderate draught, may haul to the northward, and steer about mid-channel between

Bembridge ledge and Nab rock, with St. Jude's church, Southsea, just open east of Horse fort N. $\frac{1}{4}$ E., or for the Warner light-vessel bearing north, the least water in this route being $4\frac{1}{2}$ fathoms; the above marks will lead to the eastward of the Warner light-vessel, up to the line of the leading mark into Spithead, which is Kickergill tower on with the middle of fort Monkton barracks, bearing N.N.W. $\frac{1}{4}$ W. After passing No-mans land and Horse forts, a suitable berth for anchorage may be selected according to circumstances.

There is an available channel for small vessels between Nettlestone point and the Warner shoal, the leading mark for which is Kickergill tower, on with No-mans land fort N. by W. $\frac{1}{3}$ W. which will lead through from seaward, east of the Princessa shoal, inside the Nab rock, and Warner, until Spit fort, and the round tower at Portsmouth point are in line N. $\frac{1}{2}$ E.; these latter marks will lead into fairway channel to Spithead. The least water in the above route will be $3\frac{1}{2}$ fathoms inside the Warner shoal.

In ships of large draught, from a position about a mile to the southward of the S.E. Princessa buoy, a course should be steered to the northward and eastward not passing to the northward of the Princessa clearing mark, viz., the sharp northern shoulder of Appuldercomb hill in line with Shanklin railway station W. $\frac{1}{3}$ N.—until Nab light-vessel bears N. by E., when steer for her; by doing so all the shoal patches of 5 fathoms and under in the vicinity of the Outer Nab will be avoided. After passing about a cable east of the light-vessel, steer for No-mans Land fort about N.W. $\frac{1}{3}$ N., until Kickergill tower comes on with the middle of fort Monkton N.N.W. $\frac{1}{4}$ W., when proceed with these marks on, and select an anchorage at Spithead.

When approaching the Nab light-vessel at low-water springs, during bad weather, and with a heavy sea, it might be necessary to modify the above directions for ships of very heavy draught, and approach the light-vessel from a more easterly direction, in order to preserve a depth of not less than 6 fathoms water. To do so, it will be necessary to pass two-thirds of a mile to the south-eastward of the Nab light-vessel, and then steer to the northward towards Dean Tail buoy, until Warner light-vessel bears N.W. $\frac{1}{2}$ W., when proceed for her on that bearing, until the leading marks through to Spithead come in line.

FROM the EASTWARD.—The Nab light-vessel lies N.W. $\frac{3}{4}$ W. $12\frac{8}{10}$ miles from the Owers light-vessel, the Boulder buoy being exactly midway on the same line of bearing: therefore the course to be steered for the Nab light-vessel will be dependent on the distance the vessel passes outside the Owers light-vessel. On approaching the Nab light-vessel, a ship of moderate draught might bring Kickergill tower on with the middle of fort Monkton, N.N.W. $\frac{1}{4}$ W. and proceed with these leading marks

through to Spithead ; but ships of heavy draught should pursue the route recommended to the eastward of the Nab light-vessel.

As it not unfrequently happens that Kickergill tower and fort Monkton are difficult to identify from haze, or are partially hidden by shipping at Spithead, it would be well to bear in mind that Spit fort just open east of Horse fort N. by W. $\frac{1}{2}$ W. will lead vessels of even large draught in safety to a mid-channel position, between the Dean and Dean Elbow buoys, whence there will be no difficulty in picking up the leading marks for proceeding to Spithead. In this route the least water will be $5\frac{1}{4}$ fathoms.

When turning to windward ships may stand between Dean Tail and Dean buoys into 8 fathoms at low water ; but between Dean buoy and Horse fort the sand is steep-to, and should not be approached into a less depth than 15 fathoms. Horse and No-mans land forts are of great service, when working in, standing as they do near the edges of their respective shoals, but a strict attention to the lead is necessary.

Beating through St. Helens road, if the vessel is of large draught do not stand farther to the southward than to have Foreland farm on with the eastern chalk pit on Bembridge down ; this will clear the Nab shoal and New Grounds, but to avoid the $4\frac{1}{4}$ fathoms patch, between the latter and Long rock, the chalk-pit should not be brought farther than Lane End farm. In making the northern board do not stand farther than to have the summit of Brading down on with St. Helens Sea mark, which clears St. Helens patch.

Kickergill tower on with the west end of the barracks in Fort Monkton will lead outside the Warner, and the same tower turned from end to end of the barracks in the fort will clear the shoals on both sides ; but a vessel of large draught must not bring the tower to the extreme end of the barracks, which would be attended with danger, but should go about when it is twice its own breadth within the end until she is at least 2 cables to the northward of the Warner light-vessel, when the tower may safely be brought on with the west end of the barracks, taking care that the soundings are not shoaled to less than 15 fathoms at low water, which will be a good and safe guide until past No-mans land fort. The tides must be strictly attended to when turning to windward near these shoals.

Although 15 fathoms is a good guide for a vessel working between the Warner and No-mans land, and abreast of these shoals nothing less is safe ; yet having passed westward of the No-mans land fort, she may safely stand into 12 fathoms, which will be found a safe depth the whole way up to the east end of the Sturbridge.

As the tide runs with considerable strength at springs through the channel into Spithead, vessels of small draught will find it frequently to their advantage to run over the Horse sand, and not confine them-

selves to the fairway ; but when this is done, the rise of tide should be carefully considered. From half flood to half ebb a vessel not exceeding 12 feet draught may borrow on the Horse sand as long as Block-House fort is open of Southsea castle ; and if under 9 feet draught she may do so from a quarter flood to three-quarters ebb, as the shoalest water outside of this line at springs is about 7 feet.

At NIGHT, if in vessels of moderate draught, from abreast Dunnose, steer to the eastward with St. Catherine light just open of the land bearing about W. by N., until the Nab lights bear N.E. $\frac{1}{2}$ N. ; or being about a mile off Dunnose, an E. by N. course will lead about the same distance outside the Princessa, taking care not to stand into less than 10 fathoms (at low water) until the Nab lights bear N.E. $\frac{1}{2}$ N., when they should be steered for on that bearing, until Warner light bears N.N.W., when alter course for it. After rounding Warner light-vessel at a convenient distance on its eastern side, proceed in mid-channel about N.N.W. between the lights on Horse and No-mans land forts, and anchor at Spithead in about 6 fathoms, with Warner light S. by E. $\frac{1}{2}$ E., and the *green* light on Southsea castle N.E. $\frac{1}{2}$ E. ; or otherwise as most convenient.

The above route will skirt the Outer Nab rock, but even supposing that patch be crossed, the least water will be $4\frac{1}{2}$ fathoms.

When Southsea castle light is first seen N. by E., it will appear *red* ; the vessel will then be to the westward of the Horse sand, and have the harbour channel open. The line of bearing on which the light changes from red to green is N.E. by N.

In ships of heavy draught, from a position off Dunnose, with St. Catherine light just in sight W. by N., and the Nab lights N.E., steer N.E. by E. $\frac{1}{2}$ E. until the Nab lights bear N. by E., when steer for them on that bearing ; by doing so all the shoal patches of 5 fathoms and under in the vicinity of the Outer Nab will be avoided. After rounding the light-vessel at a convenient distance on its eastern side, steer for Warner light on a N.W. bearing, and when Spit fort light opens out west of Horse fort light, a N.N.W. $\frac{1}{2}$ W. course will lead between the lights on Horse and No-mans land forts, and through to Spithead.

PORTSMOUTH HARBOUR.—The land between Gilkicker point and Selsea bill is low and broken by a deep inlet in which are the islands of Portsea, Hayling, and Thorney, and the harbours of Portsmouth, Langston, and Chichester. Portsmouth, the westernmost of these harbours, is connected with that of Langston by Hilsea creek, which separates the north end of Portsea island from the main, and is crossed by a stone bridge. There is also a passage from Langston into Chichester harbour by Hayling creek, which separates the north end of Hayling island from the main, and is crossed by a swing bridge connected with each shore by a causeway ; the

swing bridge is 23 feet wide, and there are 12 feet in the channel at high water springs.

The approach to Portsmouth harbour is defended by Gilkicker, Monkton, and Block-House forts on the west, and Southsea castle, built on the south extreme of Portsea island, on the east. At a mile within the castle, is the entrance of the harbour, 700 feet wide at high water, between Block-House fort on the west and the Round tower on the east. Within the entrance the harbour widens out, and takes a N. by E. direction for nearly $1\frac{1}{2}$ miles, when it merges into the Fareham and Porchester lakes, off which branch several smaller lakes. These lakes are bordered by mud banks, which are covered at high tide, the whole space to the northward of the dockyard forming then an expanse of water $2\frac{1}{2}$ miles long north and south, and the same east and west.

The general width of the channel within the harbour is about 2 cables and the depths in it irregular, from 8 to 3 fathoms; it is, however, considerably narrowed by the Ballast and Burrow banks, which project from the western shore. The Ballast bank begins just within Block-House point, and extends N.N.E. upwards of a quarter of a mile, its northern end being nearly half way across the channel. It is about 400 feet broad, and the least water on it, 8 feet, is near its south-west end; there are 16 feet on its eastern side, which has been lately dredged. The Burrow bank, composed of mud and stones, extends from the mud off Burrow island half way across to the north-west angle of the dockyard. It is $2\frac{1}{2}$ cables long, 2 cables wide, and has as little as 6 feet on it at low water.

Fareham lake is about $1\frac{1}{2}$ cables wide at entrance at low water; it then gradually narrows, the depths being from $4\frac{1}{2}$ to 3 fathoms for three-quarters of a mile to abreast of Bomb Ketch and Spider lakes; at a mile farther on the depth is only $1\frac{1}{2}$ fathoms. The lake then bends to the W.N.W., and becomes narrow and shoal, there being only a foot at low water at half a mile below Fareham. Porchester lake has irregular depths in it, from 5 to 3 fathoms, decreasing to 6 feet just below Porchester castle. Its direction is north and north-east for about $2\frac{1}{2}$ miles when it bends to the south-east and soon becomes a mere drain.

The town of Portsmouth stands on the eastern side of the entrance of the harbour, and is enclosed by bastioned ramparts and surrounded by a deep moat and extensive outworks. On its north side, and separated from it by Mill-dam creek, is the town of Portsea, similarly fortified. On the west sides of these towns, and occupying the whole extent of the eastern shore of the harbour are, the Town cambers, the Gun wharf, and Her Majesty's dockyard.

The western side of the harbour is fronted at low water by a mud flat, through which flow two narrow creeks named Haslar and Weevil lakes.

Occupying the whole extent of shore between these lakes is the town of Gosport, and north of it the Royal Clarence victualling yard, both enclosed on their western sides by ramparts and a deep moat. Weevil lake enters the harbour in front of the victualling yard, and a depth of 5 feet may be carried up to Her Majesty's landing pier at low water. On the north shore of this lake is the magazine, which is fortified on its land side; two piers run off, one from the east side of the magazine into the harbour, and the other from the south side into the lake. About half a mile south-west of Gosport, and separated from it by Haslar lake, is Haslar hospital, a brick building covering a large extent of ground between Block-House and Monkton forts. Gosport is connected with Point at Portsmouth by a steam bridge, and with Haslar by a bridge over Haslar lake.

The Town cambers are between Point at Portsmouth and the new Gun wharf; they both dry out at low water, and are separated by a bridge. The area of the outer camber is rather more than 3 acres, exclusive of the dry dock on its north side, which is 345 feet long, 50 feet wide at entrance, and $17\frac{1}{4}$ feet over sill at high water springs. The area of the Inner camber, in which there is a patent slip, is also about 3 acres. The patent slip is 450 feet long, and vessels of 800 tons burthen, drawing from 10 to 11 feet forward and 15 feet aft, can be taken on it at high water springs.

In the year 1866 there were 254 merchant vessels, belonging to the port, representing 16,188 tons; besides 11 small steamers. The chief imports are timber and grain; there are no exports. The total population of Portsmouth, Portsea, and Gosport, with their suburbs, in 1861 was 112,850, including military, but exclusive of 3,000 sailors afloat.

Docks.—Her Majesty's dockyard covers an area of 115 acres, its southern portion being chiefly occupied by timber ponds, chain cable, rigging, and sail stores, mast, rope, and boat houses, a boat pond, and a camber; and its northern portion by dry docks, building slips, steam basins, steam basins, steam factory, and other workshops. Its harbour frontage is about 3,500 feet in length, north and south, and about midway is the entrance to a basin 4 acres in area, with 25 feet in it, and $24\frac{1}{2}$ feet over sill at high water springs.

Into the east part of this basin open four dry docks, respectively 221 $\frac{1}{2}$, 275, 279, and 209 feet in length on blocks; $63\frac{1}{2}$, $67\frac{1}{2}$, $67\frac{1}{2}$, and $55\frac{1}{2}$ feet wide between gates, and 24, $25\frac{1}{2}$, 26, and $20\frac{1}{4}$ feet over sills at high water springs, and $20\frac{1}{4}$, $22\frac{1}{2}$, 23, and $16\frac{3}{4}$ feet at high water neaps. On each side of the basin is a dry dock opening into the harbour; that on the south side is 228 feet long on blocks, $57\frac{1}{2}$ feet between gates, $20\frac{1}{4}$ feet over sill at springs, and $16\frac{1}{2}$ at neaps; and that on the north side, 189 feet

long, 53 feet between gates, and 20 and $16\frac{1}{4}$ feet over sill at springs and neaps.

Northward of this latter dock, and facing the harbour, is a dry dock, then follow five building slips, and another dry dock. The two docks are respectively 375* and $253\frac{1}{4}$ feet in length on blocks, $88\frac{1}{2}$ and 65 feet wide between gates, and 27 and $21\frac{3}{4}$ feet over sills at high water springs, and 23 and $17\frac{3}{4}$ feet at high water neaps. The slips are $306\frac{3}{4}$, 230, $240\frac{1}{2}$, 275, and $299\frac{1}{4}$ feet in length, and $61\frac{3}{4}$, $66\frac{1}{4}$, 65, $64\frac{3}{4}$, and $68\frac{1}{4}$ feet wide at entrance.

The steam factory, steam basin, and three other dry docks, occupy that portion of the dockyard eastward of the slips. The steam basin has its opening into Buildings lake, which skirts the north end of the dockyard, off which are moored the ships for gunnery practice. Its area is 7 acres, and there are 25 feet over the sill at high water springs. The three dry docks have their opening into the basin, two on the east side and one in its south-west corner. They are respectively $302\frac{3}{4}$, 400, and $247\frac{1}{4}$ feet in length on blocks, 70, 70, and $80\frac{1}{2}$ between gates, and have $22\frac{3}{4}$, 27, and 27 feet over sill at high water springs, and $18\frac{3}{4}$, 23, and 23 feet at high water at high water neaps.

The extension of Portsmouth dockyard is now in progress on the north side of the town of Portsea, and when completed the present area of the dockyard will be more than doubled. The new works comprise rigging, repairing, and fitting-out basins, their respective areas being 17, 22, and 14 acres; there will also be four new docks, two locks, besides an extensive factory, with coal stores, &c.

TIME BALL.—Greenwich mean time is shewn daily by the dropping of a black ball from the staff of the semaphore in Portsmouth dockyard, at an elevation of 176 feet above the mean level of the sea. The ball is hoisted half way up the staff at five minutes before, and close up at two minutes before 1 p.m., and is dropped at the instant of 1 p.m. of Greenwich mean time. The position of the semaphore is lat. $50^{\circ} 48' N.$, long. $1^{\circ} 6' 15''$, or 4m. 25s. West from Greenwich.

LIGHTS.—A *fixed* light, elevated 51 feet above high water, is exhibited from a lighthouse in the north corner of Southsea castle, and in clear weather is visible from a distance of 9 miles. It appears bright *red* in the channel between the Spit refuge buoy and Horse fort, or between the bearings of N. by E. and N.E. by N., but it shows *green* to the westward of the Spit buoy, or between N.E. by N. and E. $\frac{1}{4}$ N.; to the eastward of the Horse fort it is invisible. When coming from the eastward it is first

* This dock, 375 feet long, and the one 247 feet long in the south-west corner of the steam basin, can be used as one dock if required.

seen when bearing N. by E., and is of a faint *red* colour ; on that bearing it will lead about four-tenths of a mile westward of the Horse fort, and nearly hit the Boyne buoy.

A *red* light is exhibited at each outer end of the Clarence Esplanade pier near the Kings Rooms on Southsea beach, in order to facilitate the approach of steam-vessels at night. A *green* light at the north outer end, and a *red* light at the south outer end of Victoria pier at the bottom of High Street, Portsmouth ; and *red* or *green* lights are shown at the landing places and piers within the harbour.

SPIT SAND, FORT and LIGHT.—Spit sand is an immense accumulation of coarse calcareous sand and gravel, thickly mixed up with minutely broken shells, and is a valuable protection to the harbour. No natural formation of rock is found near the surface, but there are numerous patches of large stones the whole way along Haslar beach, probably from the destruction of the neighbouring Government works during heavy gales. The shape of this sand somewhat resembles a cone, the base of which rests upon Haslar beach, and occupies the whole distance from Monkton fort to Block-House, the apex or spit extending off nearly $1\frac{1}{2}$ miles in a line perpendicular to its base. The general depth over it is from 7 to 10 feet, but some shoal spots have as little as $4\frac{1}{2}$ feet, and are consequently dangerous for small vessels.

A quarter of a mile within the 3-fathom outer edge of the Spit sand is Spit fort, about 70 yards in diameter, now in course of construction, and from a small turret 34 feet above high water is exhibited a *fixed* white light.

Hamilton bank dries in spots at the lowest tides, when it has only 5 feet water over its outer end, which is nearly three quarters of a mile from Haslar beach. A dangerous shoal composed of hard coarse sand, called the Ridge, nearly 500 feet in length and not broader than a boat, lies near the outer end of the Spit sand, and has only 3 feet over it at low water ordinary springs.

Harrow bank, a shoal patch of gravel and stones, which nearly dries at low water, extends about 2 cables from the beach near Monkton fort, and is much in the way of small vessels coming round Gilkicker point, or crossing over from Ryde. They will pass more than a cable south of it by keeping the cupola of St. Pauls chapel at Southsea in one with the flagstaff on the Kings bastion, until the new Gun-wharf clock-tower is in line with the Round tower ; this latter mark—useful for boats—will lead between Haslar beach and the Hamilton bank in not less than 3 feet at low water.

DIRECTIONS.—With an accurate knowledge of the state of the tide, and by attending to the following marks, the Spit sand is not so dangerous

for small vessels as is generally supposed. Crossing it from the southward, keep the Dockyard semaphore in line with the Round tower, and it will lead in 6 feet at low water eastward of Hamilton bank. Crossing from the westward, keep a white stuccoed house on Southsea common in one with Dock mill, until the semaphore comes on with the Round tower. The officers houses at the entrance of Gun-boat yard, showing just clear of the eastern part of Haslar hospital, leads along the western edge of Hamilton bank in 6 feet water; and the Round tower in one with the Gun-wharf clock leads up in-shore of the bank in not less than 3 feet at low water springs,—a useful mark for small steamers at a proper rise of tide.

The Swatchway beacons on Southsea beach in line, E. by N. $\frac{1}{2}$ N., lead over the Spit, in 8 feet water, midway between Hamilton bank and a shoal patch with 5 feet water, called the Elbow knoll; and when St. Thomas church comes in line with outer angle of Spur redoubt, it will lead up to the Bar marks.

The depths of 8 or 9 feet water across the sand will be found by keeping the spire of St. Jude's church at Southsea in line with the east end of Charlton house—built of yellow and red bricks, standing at the back of the inner Swatchway beacon—until the tower of St. Thomas church comes on with the west or outer angle of the Spur redoubt; this latter mark will lead into the fairway in not less than 9 feet at low water.

The marks for clearing the Ridge with only 3 feet water, lying near the south-west extreme of the Spit are, the outer Swatchway beacon in line with west tower of Pier hotel; and the Gun-wharf clock-tower in line with the outer angle of Spur redoubt. The new Gun-wharf clock-tower in line with the west or outer angle of the Spur redoubt will lead to the westward in not less than 8 feet at low water.

Bar Knolls.—On the outer bar of Portsmouth harbour, a knoll composed of loose shingle, with 18 feet water, is marked on its western edge by a black can buoy, which lies in 19 feet water, with Southsea castle light-house N. by E. $\frac{1}{2}$ E. rather more than a mile, and the Spit beacon buoy N.W. by W. one-sixth of a mile. A similar knoll, with 22 feet water, lies S.W. $\frac{3}{4}$ S. from the above.

The ENTRANCE CHANNEL into Portsmouth harbour, between the end of the outer Spit and Horse sands is four-tenths of a mile wide, but it narrows considerably abreast Southsea castle, being intercepted by a considerable projection from the main body of the Spit called the Elbow, which is detached at its outer end only by a deep gut or blind channel.

Southsea beach, with the exception, of the shoal off Southsea castle, is steep-to, and may be approached to half a cable without danger till abreast the Bar, where the channel is considerably narrowed by the East sand, a

bank of sand and gravel, which commences at the mouth of the harbour, and running parallel with the beach terminates in a spit nearly as far south as the Swatchway beacons. The general depth on this sand varies from 7 to 10 feet; but the East knoll, a shoal patch of only 5 feet, lies a little to the northward of the baths, at about half a cable from the beach. A deep gut called Southsea pool runs up inside the East sand, or between it and the beach, having 6 or 7 fathoms at its entrance; but it offers no channel into the harbour, as it gradually narrows into a point, and decreases in depth as its northern end is approached.

Buoys.—There are no buoys to mark the western edge of the Spit, but the channel on eastern side of the sand is clearly pointed out by seven buoys, chequered black and white. The outer and southernmost one, known as outer Spit buoy, and the Spit refuge buoy, are described at pages 173 and 174, whilst the remainder are numbered consecutively from 1 to 5, commencing from the S.E.

No. 1 buoy is placed near the south-east point of the Elbow in 30 feet water; No. 2 buoy lies $1\frac{1}{2}$ cables within it to the northward; No. 3 buoy upon the inner shoulder of the same bank in 12 feet; and Nos. 4 and 5 buoys lie nearly in a straight line between No. 3 buoy and Block-House point, in 15 and 18 feet respectively, the whole clearly and accurately marking the west side of the entrance channel.

Two black buoys, numbered 1 and 2, mark the western edge of the East sand, and they must be left on the starboard hand in entering; No. 1 being the southern or outer buoy.

The BAR is formed by a gravel bank which connects the eastern edge of the Elbow with the outer spit of the East sand, and is steep-to on both sides. Prior to 1861 there were only 12 feet over the bar at low-water ordinary springs; it was then dredged to $17\frac{1}{2}$ feet, so that the depth at high-water springs is 30 feet, and at high-water neaps $27\frac{1}{2}$ feet.

Although the channel is narrow on the bar, its limits are well defined in entering by the five buoys, viz., Nos. 1 and 2 black, on the starboard hand, and Nos. 3, 4, and 5, chequered black and white, on the port hand. The mark for leading through is the red beacon at the south-west end of Block-House fort, in one with the black beacon on the Gosport fortifications, bearing N.N.W. $\frac{1}{4}$ W.

DIRECTIONS.—It is not customary for Her Majesty's ships to go in or out of Portsmouth harbour without a pilot, neither is it prudent for any large ship to do so; but in small vessels such assistance is not absolutely necessary, if ordinary attention be paid to the buoys and the following directions. It may, however, be taken as a general rule, that it is utterly useless to attempt entering against the tide, except with a commanding

breeze or under steam, nor should a vessel venture to work in without a pilot.

In sailing in with the tide, particularly at its strength (at springs it runs $4\frac{1}{2}$ knots), the utmost caution must be used; for what with the generally crowded state of the harbour, the constant crossing of the steam bridge, and the numberless boats continually in the vessel's track, it is always attended with great anxiety and some risk. The best time for entering is near slack tide, about half an hour before high water, or upon the slack which occurs between the 2d and 3d hour's flood, which continues for about three-quarter's of an hour. The flood is strongest between the 5th and 7th hours, and the ebb at the 3d and 4th hour, when its rate at the entrance is $4\frac{1}{2}$ knots.

On the flood in a small steamer, or with a slant of wind in a sailing vessel, it is perhaps best to run well up the harbour past the thick of the shipping, and then turn the vessel's head upon the tide, which will afford time and give facility for taking up a berth; but upon the ebb the vessel may steer direct for her intended berth. Under all circumstances it cannot be too strongly impressed, that judicious and moderate sail, a steady attentive helmsman, with an anchor in constant readiness, are necessary precautions in entering the harbour.

It is not unusual for merchant vessels to secure themselves to the Queen's buoys; and as by so doing they incur a penalty, they are hereby reminded of the risk they run. The commanders of Her Majesty's small vessels are also cautioned not to make fast to the Can buoys, which belong to the anchors of the guard ship's moorings.

TIDES.—In Portsmouth harbour it is high water, full and change, at 11h. 41m., and low water at 4h. 30m.; springs rise $12\frac{1}{2}$ feet, and neaps 10 feet. A narrow stream runs in 15 or 20 minutes after high water. North-east winds keep the tides back; south-west winds have a contrary effect. The highest tide on record occurred during a heavy gale from the S.W., 13th November 1840, four days after the full moon, when the tide rose $17\frac{1}{4}$ feet.*

The tide during the first 4 hours of flood rises 6 inches less than in the last 3 hours; and during the last 2 hours of ebb it falls 2 feet more than in the first 3 hours. The flood in this harbour is also of longer duration than the ebb by about 2 hours—the flowing continues about 7 hours, and the ebbing 5 hours—a condition which is found more or

* The zero or datum of the soundings on the chart is 5 feet 8 inches on Master Attendant's Tide-gauge, which is equivalent to 7 feet below the mean level of the sea; the zero of the Admiralty Tide tables is 6 feet 4 inches below that level.

less at Chichester, Langston, Southampton, and in all the harbours of the Solent, and with the unequal rise and fall may be thus explained.

During the first 4 hours of flood the water rises slowly, yet almost uniformly, about 6 feet, apparently supplied by that portion of the incoming or eastern stream in the channel, which splits off the Needles (*see* page 135), one part flowing through the Solent at Spithead. At $4\frac{1}{2}$ hours after the commencement of this stream, or about 9h. 30m. on full and change days, the western stream has made inshore all along the coast, from Selsea Bill westward to the Bill of Portland.

This western stream unites with the last of the eastern stream round the eastern end of the island, and runs back through Spithead, giving increased effect to that same incoming stream of flood in the Channel, by contributing to fill the harbours in its progress to the westward in an accelerated degree, and also to prolong the duration of the rising tide, until the stream has turned in the offing a little after 11 o'clock, thus making a whole flood, or rising tide, of 7 hours. So long as the western stream maintains its strength through Spithead, the water is kept up or prevented from falling out of Portsmouth harbour, and this check holds out until the stream at Spithead slackens, when both Portsmouth harbour and Southampton water rapidly empty themselves.

On the Spit sand, with the Swatch marks in line, the stream turns nearly the same time as at Spithead. The first 4 hours of flood sets towards Southsea beach from a quarter to three-quarters of a knot, the remaining 3 hours towards the harbour, about three-quarters of a knot. The ebb sets first West, then S.W. and S.E., at the last 2 hours towards the Spit buoy, from one to $1\frac{1}{2}$ knots.

At the Spit refuge buoy the streams turn a little later than at Spithead. The first 4 hours of flood runs E.S.E. towards Langston bar; during the 5th hour it turns and sets weakly towards Southsea castle; the remainder of the tide sets at the rate of about a knot towards the harbour. The direction of the ebb is the same as in the Swatchway, but its rate is less. Off Southsea castle the flood turns a little earlier than at the Spit buoy; its direction is the same, but its strength is greater. The ebb sets W.S.W., then South and S.E. for the last 3 hours, with a velocity of $2\frac{1}{2}$ knots.

On the Bar the flood makes towards the harbour at 8h. 15m., or $3\frac{1}{2}$ hours before high water. The first half sets, as in the Swatchway, weakly towards Southsea beach; the rate of the latter half is about $1\frac{1}{2}$ knots, which increases to $4\frac{1}{4}$ knots at the entrance of the harbour, when it gradually decreases to $2\frac{1}{4}$ knots abreast the dockyard, and to $1\frac{1}{2}$ knots off Hardway. The ebb does not make to the S.E. on the Bar till about 1h., being influenced by the Spithead tide; it runs weakly at first, but the last 3 hours it sets through the harbour channel at the rate of $2\frac{1}{4}$ knots; at the 4th hour its rate at the entrance is $4\frac{1}{2}$ knots.

At Fareham, in the channel close to the upper town quay, it is high water, full and change, at 11h. 47m., and low water at 4h. 30m.; springs rise $11\frac{1}{2}$ feet above the level of low water (there are then only 9 inches water in the channel), and neaps rise $8\frac{1}{2}$. At springs (2 days after full and change) the tide begins to rise about $1\frac{1}{2}$ h. after, and at neaps 18m. after, low water at Portsmouth. The flood stream ceases about high water at the quay, stands about 10 minutes, when the ebb commences. At Fareham bridge, just below the mill, it is high water at about the same time; springs rise $7\frac{1}{2}$ feet, and neaps $4\frac{3}{4}$ feet. At springs the tides begin to rise at the bridge $4\frac{1}{2}$ hours after low water at Portsmouth.

In Portchester lake, off the castle, it is high water at 11h. 45m., and low water at 4h. 35m.; springs rise $13\frac{1}{2}$ feet, and neaps $10\frac{1}{4}$ feet. The flood stream ceases about a quarter of an hour after high water, stands about 7 minutes, when the ebb commences.

In Hilsea creek, about a third of a mile west of Portsbridge, it is high water at 11h. 47m.; springs rise $6\frac{1}{2}$ feet above the bed of the channel (the channel at springs is dry at $4\frac{1}{2}$ h. after high, or about 25m. before low water at Portsmouth, and at neaps at 3h. 35m. after high or $1\frac{1}{4}$ h. before low water there), and neaps rise and range 4 feet; this channel remains dry about $5\frac{1}{2}$ h. at springs, and 6h. at neaps. At springs the tide begins to rise 5h. after low, or $2\frac{1}{4}$ h. before high water at Portsmouth, and at neaps $4\frac{3}{4}$ h. after low, or 2h. 40m. before high water there. A spring tide rises only for about 2h. 20m., a neap tide 2h. 45m.

At Spithead, and anywhere between the Bramble and Horse sands, the eastern stream, at full and change, makes at 2h. 0m.—about $2\frac{1}{2}$ hours after high water in the harbour—and runs 7 hours S.E. by S.; and the western stream at 9h. 0m.—about $2\frac{1}{2}$ hours before high water in the harbour—and runs 5 hours N.W. by N. This inequality is caused by a strong counter stream running from Southampton water to Bembridge for 2 hours; for as soon as the western stream at Spithead has slacked, the rapid discharge from Southampton water and Portsmouth harbour produces such an increased velocity in the back water as to turn or beat back from its course the languid stream through Spithead. Thus the western is converted into an eastern stream, until the channel widens between the Horse and Bembridge point, where—near the Nab—it meets the regular Channel ebb, and the confluent streams sweep round to the southward of the Isle of Wight. Thus the ebb for the last half of its duration runs in opposite directions on the two sides of the eastern half of the Isle of Wight.

At the Dean Elbow, the eastern stream which sets over that shoal makes at 2h. 0m., runs to the S.E. for 2 hours, and then East for the remainder of the tide, $5\frac{1}{2}$ hours; the western stream makes at 9h. 45m., and runs W.N.W. $4\frac{1}{4}$ hours.

Near the Horse Elbow, the tide must be strictly attended to, for in many cases it sets directly over that shoal. The eastern stream makes at 2h. 0m., or $2\frac{1}{2}$ hours after the tide on the shore, and runs to the S.E. $7\frac{1}{4}$ hours; the western stream makes at 9h. 15m., or $4\frac{3}{4}$ hours after low water on the shore, and runs nearly 5 hours to the N.W.

At the Warner the eastern stream makes at 2h. 0m., and runs $7\frac{1}{2}$ hours about S.S.E.; and the western stream at 9h. 30m., and runs nearly $4\frac{1}{2}$ hours N.N.W.

At the Nab rock, the tidal stream is nearly rotary, which is probably caused by the Spithead tide meeting the tide round Dunnose somewhere near the rock; for instance, at the 1st hour's flood, by the shore it sets East; 2d and 3d hours, E.N.E.; 4th, N.E.; 5th, N.E. by N.; 6th, North; 7th, N.N.W. to N.W.; and the last drain of the flood, N.W. by W. The 1st hour's ebb sets W. by N.; 2d, W. by S. to W.S.W.; 3d, S.W. by W. to S.W.; 4th, S.W. $\frac{1}{2}$ S.; the first part of the 5th hour, S.S.W., gradually trending to the southward until low water by the shore, when its direction is S.E. There are only a few minutes slack. At full and change, the western stream makes at 11h., and the eastern stream at 4h. 30m. As this latter stream sets for 5 hours towards Bracklesham bay and the entrance of Chichester harbour, the mariner must be on his guard, especially in thick weather.

At the N.W. Princessa buoy, the western stream makes at 10h. 0m., and runs 6 hours W. by S. $\frac{1}{2}$ S. The eastern stream commences at 4h. 0m., and sets nearly E.N.E. At the S.E. buoy the tides are about half an hour later, and set as follows:—the western stream, first part, W. $\frac{3}{4}$ S., gradually becomes more southerly, and at the last of the tide runs S.W. by S. The course of the eastern stream is nearly the same throughout the whole of the tide, E. by N.

The greatest velocity of both streams is as follows:—At the Princessa, eastern stream nearly 2, western stream $2\frac{1}{4}$ knots; at the Nab rock, eastern stream about one, western stream $1\frac{1}{2}$ knots; at the Dean Elbow, eastern stream $1\frac{3}{4}$, western stream $1\frac{1}{4}$ knots; at the Warner, eastern stream $1\frac{1}{2}$, western stream 2 knots; and at Spithead, eastern stream $1\frac{1}{4}$, and western $1\frac{3}{4}$ knots.

LANGSTON HARBOUR separates Portsea island from Hayling island, and its entrance lies E. $\frac{3}{4}$ S. $2\frac{1}{2}$ miles from Southsea castle, between Cumberland fort and Gunnen point. It is utterly worthless as a port except for vessels of very light draught, as its bar nearly dries at low water, and it can only be entered by crossing the Horse and Dean sand.

The gravel banks, which dry off for at least a mile from the mouth of the harbour on both sides, are called East Winner and West Winner. The former runs nearly straight out from the coast; but the latter, after

extending three-quarters of a mile, suddenly turns to the eastward towards the spit of the other, almost blocking up the entrance, there being only a foot water between them on the bar at low spring tides. These banks frequently shift, and in height they are seldom the same before and after a gale of wind. When surveyed in 1843 there were only 9 feet over the outer bank at high water, and not more than 7 feet upon the inner part of the eastern winner. In blowing weather, if any swell is up outside, there is one sheet of broken water over them, with heavy rollers. Haslar hospital open of Southsea castle N.W. leads to the southward of the banks in 9 feet at low water.

DIRECTIONS.—As the tide sets with great velocity between the entrance points of Langston harbour and in the channel when the banks are uncovered, it would be useless for a sailing vessel to attempt entering against it; the best time for running in is about an hour before high water. It makes into the harbour on full and change days, at 5h. Om., and out or to the southward at 12h. Om., which is 20 minutes later than high and low water by the shore; springs rise $13\frac{1}{2}$ feet, and neaps $10\frac{1}{2}$ feet, but uncertain to a foot or two.

In running over the bar into the fairway channel of the harbour, bring the west end of the officers' houses in Cumberland fort in line with the eastern end of the large chalk-pit on Portsdown hill, bearing N. $\frac{3}{4}$ W.; and as soon as the water deepens the vessel will be in the channel, when a course should be steered between the points. There are no regular pilots for the harbour, but if none of the local fishermen are at hand the anchor should be dropped when in safety, and wait for further assistance.

HAYLING BAY is between Langston and Chichester harbours, and its shore, which is the southern face of Hayling island, is one uninterrupted line of shingle. Many of the objects near the coast on this island are useful and familiar sea marks; the most prominent are, Hayling church, the trees in the village, and the new buildings near the beach, including Westfield lodge, a large house with a tower, and the life-boat house. To the eastward of the Dean Elbow buoy rather deeper water may be carried closer in-shore, but the difference is scarcely appreciable until about a mile eastward of Chichester harbour. The soundings are, however, so regular, and the water shoals so gradually with a few exceptions, that there can be no difficulty in keeping off a proper distance according to the vessel's draught.

A Life Boat is stationed at Hayling island.

Hayling Knob.—A small patch of foul ground, known as Church rocks, lies about a mile eastward of Langston harbour; but being close in-shore, forms no prominent shoal. There is, however, outside the Church

rocks, at $1\frac{1}{2}$ miles off shore, a small gravel bank called Hayling knob, with only 8 feet water over it, and 14 feet between it and the land. From the shoalest part of the knob, Sinah barn, N. $\frac{1}{4}$ W., and Cackham tower, is its own breadth open South of Berry barn E. by S. $\frac{1}{4}$ S. The tower in one with the barn leads to the northward; and Haslar hospital open of Southsea castle bearing N.W. to the southward.

CHICHESTER HARBOUR has its entrance $3\frac{1}{2}$ miles eastward of Langston harbour, and the watch-house on the eastern point bears N.N.W. $\frac{3}{4}$ W. $6\frac{1}{2}$ miles from Selsea Bill, and N.E. $\frac{1}{4}$ E. $5\frac{3}{4}$ miles from the Nab light-vessel. Although a considerable trade is carried on in this harbour, the entrance to it is bad, as the bar has only 2 feet over it at low-water springs; and a shoal flat, which is a continuation of the Horse and Dean sand, extends off abreast it for at least 2 miles, with not more than 15 feet water.

The gravel banks dry $1\frac{1}{2}$ miles from Watch-house point, the eastern point of entrance, and are known as East Pole sand, which is high in some parts, and constantly undergoing alteration with each gale of wind, and spring tide during the winter months. The general direction of the banks is about W.S.W., thus throwing the entrance of the harbour to the westward, the reverse of Langston. When surveyed in the summer of 1843, the higher banks were a long way out and had not more than 5 to 6 feet over them at high-water springs. On the western side of entrance, a bank of inconsiderable extent, called the West Pole, runs out about a quarter of a mile from Eastoke point.

TIDES.—It is high water in Chichester harbour, on full and change days at 11h. 30m., and just within the entrance springs rise 14 feet, and neaps 11 feet. About a mile outside the bar, the set of the stream is nearly rotatory and of little strength, turning to the eastward at 4h. 50m., and to the south-west at 12h. 45m.; between the points and in the channel over the bar, when the banks are uncovered, it runs with great force.

DIRECTIONS.—No prudent seaman, without a thorough knowledge of this harbour, should attempt it without a pilot, who will be found constantly on the look-out at tide time at the entrance, as there are no buoys or beacons to mark the channel. Should circumstances, however, render it necessary to take the harbour without a pilot, care must be taken to preserve a tolerable offing until a proper rise of tide for entering; and for this purpose, it should not be approached nearer than to have Haslar hospital open of, or just touching Southsea castle, which will insure 3 fathoms at low water. In fine weather and a smooth sea an anchor should be dropped under foot, if too soon upon the tide, and as the ground is everywhere good, the position chosen for so doing must depend upon

the direction of the wind. As there is no channel into the harbour, except to the westward of the East Pole, do not anchor farther eastward, in westerly winds, than to have the coast guard watch-house to the eastward of Bow hill.

Approaching from the southward or eastward, especially with the wind in that direction, the best mark for crossing the bar is, the watch-house on Watch-house point in line with a remarkable plantation to the eastward of Bow hill, N.E. by E. $\frac{1}{2}$ E.; this will lead well into the fairway and when there, which the increased depth of water will give a sufficient warning of, steer up between the points, the nearer in mid-channel the better, as on the strength of the tide the eddies are strong on both sides, either within or without the points, according as it is flood or ebb.

Entering from the westward run with Cackham tower in one with Berry barn, E. by S. $\frac{1}{2}$ S., which will lead to the northward of Hayling knob, and over the bar, in 17 feet at high water springs; but as this line points to the highest part of the East Pole, do not continue on it longer than to have the fairway mark on. When there is any swell outside, the sea breaks furiously over the sands, and even across the entrance, particularly with southerly winds on an ebb tide.

If bound to Emsworth, enter the Emsworth channel, which is close to the high shingle point on the western side of the harbour; but as it would be folly to attempt to proceed farther up without a pilot, the anchor should be dropped to prevent confusion, and as there is no avoiding the strong tide (which on the ebb is rapid), a good look-out must be kept, in the event of the vessel driving.

In the eastern or Chichester branch, there is fair anchorage for many vessels even of considerable burthen; but a sort of inner bar or shoal flat connects Watch-house point with Gardner head, and a vessel, to have the best water over it, must bring the old cottage at East Saltern in line with the high water shingle point on the western side of Emsworth channel. This mark will lead to the anchorage, which may be said to commence about half a mile eastward of the watch-house, or soon after passing the coast-guard hulk, in 4 to 5 fathoms at low water.

With a probability of remaining any length of time at this anchorage, it would be prudent to steady the vessel with a stream anchor, and for this purpose the small bower should be let go near the middle of the stream, and the small anchor carried over towards the southern mud; veer upon the bower, and heave in upon the stream, which will take the vessel out of the strength of the tide, and also out of the fairway, and she will have open hawse up the harbour, which is advisable, as the ebb rushes down with great rapidity. The bower will also be a safe precaution against driving over upon the southern mud, which there would be some danger

in doing, in strong northerly winds. Chichester lake is navigable to Dell quay, within 2 miles of the city.

A Life Boat is stationed at Chichester harbour.

The COAST between Chichester harbour and Selsea bill runs nearly in a straight line, and forms a low earthy bank, which is seriously encroached upon by the sea. There are many conspicuous objects near the shore, which being useful sea-marks, it may be well to point out their relative positions.

Berry barn is a large and remarkable building close upon the edge of the coast, about a mile eastward of Watch-house point, and is the second building from it; Oxtall barn is about half a mile to the westward. West Wittering church, with a spire, is conspicuous, and stands a short distance back. Cackham tower is a high brick ruin, a quarter of a mile to the eastward of Berry barn, and about the same distance back from the coast; it has a plantation near it. The little village of Circum runs close down to the coast, and may be known by a row of white houses near the beach belonging to the coast-guard, the first station east of Chichester harbour. Circum windmill, a useful mark, stands at the back of the village, and the first farm-building to the eastward is Bracklesham farm.

Thorney coast-guard houses are $2\frac{1}{4}$ miles to the south eastward of the coast-guard station at Circum; and three-quarters of a mile to the eastward of the above, and rather more than a third of the distance to Selsea bill, is Medmerry barn, one of the objects used for clearing the Boulder bank. Selsea windmill stands a quarter of a mile to the eastward of Medmerry barn, and farther back. The coast-guard houses at Street, a useful sea mark, are between Medmerry barn and Selsea bill; and immediately behind them stands a remarkable high house at the south end of the village of Selsea, or, as it is sometimes called, Street.

Selsea bill is a low projection of the coast, and shows when above the horizon in a remarkably sharp low point when seen from east or west.

A Life Boat is stationed at Selsea bill.

DIRECTIONS.—Small vessels under 14 feet draught may turn to windward in-shore out of the tide in Bracklesham bay frequently with advantage, by a close attention to the lead and the following directions, taking care not to stand within half a mile of the shore, as the bank is steep-to, shoaling suddenly from 4 to 2 fathoms.

A vessel will be to the eastward of the East Pole sand when Cackham tower is in one with Chichester spire; and the low water banks will be cleared when West Wittering church is in line with the cathedral; but to insure clearing the whole of the shoal flat which extends off Chichester harbour, the coast should not be approached until the cathedral is open

eastward of Circum windmill; and thence to the Street rocks the bay is safe, with the exception of the Medmerry bank and the Hounds rocks; the latter are awash at low water.

Medmerry Bank, lying 2 miles from the coast and W.S.W. of Medmerry barn, is rather an extensive shoal of gravel and broken shells, and nearly streams with the entrance into the Looe. Its direction is nearly north and south, three-quarters of a mile long, and not less than half a mile broad. The marks for the shoalest part of 13 feet, which is near its centre, are:—Selsea mill in one with the Luff—a clump of trees on the left shoulder or western part of the high ground to the eastward of Rooks hill—bearing E.N.E.; and Belmont castle in line with the watch-house N. by W. $\frac{1}{3}$ W. The north-east end of the large chalk-pit on Portsdown hill in line with the south-west end of Hayling trees, will lead in 4 fathoms to the westward of the bank; the watch-house on the eastern side of entrance to Chichester harbour N. by W. $\frac{3}{4}$ W. leads to the eastward; and Bracklesham farm, in line with Bow hill, leaves it to the southward.

Bullock Patch.—As there is but little less water on Medmerry bank than must be passed over in taking the Looe channel, it is not a danger to vessels intending to do so; but it would be imprudent for those of large draught to come within the line of the Boulder bank, for a rocky patch of 28 feet named the Bullock lies W. $\frac{3}{4}$ N. nearly 5 miles from Selsea bill. Ashey Down tower in line with Bembridge church spire W. by N. $\frac{3}{4}$ N., leads close to its southern edge.

About 2 cables south-west of the south end of the patch a black can buoy is moored in 7 fathoms, with Ashey Down tower, open West of Bembridge church W. by N. $\frac{1}{2}$ N.; Nab light-vessel N.W. by W. $\frac{1}{2}$ W. $3\frac{1}{10}$ miles; Dean Tail buoy N.W. $\frac{1}{2}$ N., $3\frac{2}{10}$ miles; and Boulder buoy S.E. $3\frac{4}{10}$ miles. Should the buoy be gone, a bearing of Ashey Down tower or Nab light-vessel will enable a ship to keep outside the patch, until the east end of the large chalk-pit on Portsdown hill comes on with east end of Cumberland fort.

Hounds Rocks are connected with the coast at their eastern end immediately under Thorney coast-guard houses, and uncover at spring tides for rather more than half a mile off-shore in a W.N.W. and E.S.E. direction. Nelson monument over the west end of Hayling trees leads a mile outside them.

There is a small patch with $2\frac{1}{2}$ fathoms water, three-quarters of a mile N.W. by W. $\frac{3}{4}$ W. from the Hounds rocks, and $1\frac{1}{10}$ miles from the shore; there are 5 fathoms close to all round it.

CHAPTER VI.

SELSEA BILL TO NORTH FORELAND.

VARIATION IN 1869.

Shoreham Harbour	-	20° 30' W.		Dungeness	-	-	19° 25' W.
Newhaven	-	20° 20' W.		Downs	-	-	19° 34' W.

The OWERS appears to be applied indiscriminately as the general name for the foul ground off Selsea bill, as well as the extensive and dangerous patches of rock at least 5 miles south-east of it. With the exception of the narrow channel known as the Swatchway, these dangers form an almost continuous ledge of dangerous rocks ; but as distinguishing names, well known to the local pilots and fishermen, have been given to the different parts of this shoal, they have been adopted in the following description.*

The Streets.—About three-quarters of a mile westward of Selsea bill, and abreast the High house at Selsea Street, the Owers have their commencement, and run off in two parallel ledges, called the Streets, which are awash at the lowest tides to the distance of a mile S.W. by W. $\frac{1}{4}$ W. from high-water mark ; and thence they trend suddenly S.E. by S. for rather more than three-quarters of a mile under the name of the Grounds or Malt Owers at their western end, and the Dries at their eastern end. About a quarter of a mile southward of the Dries, a conical black buoy is moored in 12 feet water, with Selsea coast-guard houses N.N.E., and the Mixon beacon E. $\frac{3}{4}$ S. $1\frac{1}{6}$ miles.

The Mixon.—A mile E.S.E. of the Dries is a considerable mass of rocks known as the Mixon, the highest and eastern end of which covers at a quarter flood. Between the Mixon and the Dries there are 10 to 14 feet water, gradually shoaling to the shore. The beacon, erected on the highest part of the Mixon close to the eastern end, is a useful object for vessels navigating the Loos, and a valuable sea mark for the outlying dangers ; it consists of an iron pillar with cage 30 feet above high water, and lies about S. by E. one mile from the southern rounding of Southsea bill.

* See Admiralty Charts :—England, South Coast, Sheet 5, Portsmouth to Beachy Head, No. 2,451, scale m = half an inch ; and Owers to Christchurch, including Spithead, No. 2,045, scale m = 1·4 inches.

An extraordinary deep hole, of no great extent but having upwards of 12 fathoms in the deepest part, is scooped out near the south-east end of the Mixon close to the face of the rock. At low water there is no channel between Selsea bill and the Mixon, as they are connected by a gravelly bank interspersed with mud and weed, which dries at low-water springs.

Brake or Cross Ledge is a continuation of that portion of the Streets shoal known as the Dries, in a S.W. by W. direction, and forms a rocky bar with from 10 to 25 feet across the western entrance to the Looe.

Boulder Bank.—The northern end of this dangerous shoal is on the south side of the western entrance to the Looe, and extends in a south-westerly direction for a mile, whence it trends $3\frac{1}{2}$ miles S.E. by E. to the end of the Middle Owers, forming an extensive and almost continuous shoal, though distinct names are assigned to different parts. That portion known as Boulder bank is composed of gravel, stones, and rocky heads, and has on its shoalest part only 2 feet water, whence the spire of Chichester church open west of Selsea mill bears N.E. by N., and the Mixon beacon, E. by N. $\frac{1}{2}$ N.

The Pullar buoy, conical, with black and white vertical stripes, is placed at the north-east or inner end of the Boulder bank, in 12 feet water, and marks the southern boundary of the entrance to the Looe; from it Chichester church spire is on with lower grove of trees west of Selsea mill N.N.E. $\frac{3}{4}$ E.; the Mixon beacon, E. $\frac{1}{2}$ N.; and Boulder buoy, S.W., a little more than a mile distant.

The Boulder buoy, conical and black, lies in 9 fathoms water off the S.W. angle of Boulder bank, midway on the line of bearing between the Owers and Nab light-vessels, with Chichester church spire in line with Medmery barn N.E. by N.; Nab light-vessel, N.W. $\frac{3}{4}$ W. $6\frac{4}{10}$ miles; Bullock patch buoy, N.W. $3\frac{4}{10}$ miles; and Owers light-vessel, S.E. $\frac{3}{4}$ E., $6\frac{4}{10}$ miles.

Middle Owers is the eastern portion of the extensive shoal just described, and limits the principal or main Swatchway to the westward. It is composed of large blocks of stone, or rock, alternating with patches of coarse gravel, having one dangerous head, which nearly dries at low water.

The Middle buoy, can, and chequered black and white, lies in 5 fathoms water, an eighth of a mile inside the shoal just abreast the shoalest part, with Chichester church spire its apparent length east of Selsea corner, N. by E. $\frac{1}{4}$ E.; East bank buoy, E. $\frac{1}{2}$ S., $3\frac{2}{10}$ miles; and Owers light-vessel S.E. $\frac{3}{4}$ S. $3\frac{3}{10}$ miles.

Between the Boulder bank and Middle Owers are two narrow channels, which show distinctly when the tide is running, by the ripples over the shoals near them; and as they carry $3\frac{1}{2}$ to 4 fathoms water, they might

serve a useful turn to small vessels, although from their extreme narrowness they can scarcely be recommended as safe. The *Mixon* beacon in one with the first clump of trees eastward of *Pagham* church, N.E. $\frac{3}{4}$ N., leads through the western channel in about 20 feet; and the beacon in line with *Chichester* spire, N. by E. $\frac{3}{4}$ E., leads through the eastern channel, but in rather less water.

The SWATCHWAY.—Between the *Middle Owers* and the west head of the *Outer Owers* is a channel known as the *Swatchway*, eight-tenths of a mile broad between its 3-fathom lines, with from 5 to 7 fathoms water; but though thus available as regards space and depth for ships of moderate draught, it is not recommended, for the saving of distance would be scarcely appreciable, whilst there is a possibility of a ship being entangled amongst the shoal flats in the *Park*.

Should the *Swatchway* be used, the following marks will lead through in safety, though it must be borne in mind that the objects are distant, and not readily recognized by strangers: *Kinnaird* house in one with *Clarence* hotel at *Bognor*, N.E. $\frac{1}{4}$ N., leads through on the western side of the channel; *Mixon* beacon on with coast-guard house at *Selsea* Street N. by W., leads through on the western side; whilst *Selsea* corner in one with the *White way* on *Bow hill* N. $\frac{3}{4}$ E., leads through in mid-channel. After passing through from the southward with either of the above marks, the *Middle Owers* buoy should be brought to bear W. by S. $\frac{3}{4}$ S., and an opposite course steered to pass between the inner end of the *Outer Owers* and the shoal patches to the northward.

OUTER OWERS is the outer and most dangerous of the numerous shoals off *Selsea* bill, and its off-lying position, combined with strong tides and heavy seas during southerly gales, renders it one of the most formidable dangers in the *English channel*. The shape of the shoal is very irregular, and its limits difficult to define, but it occupies an extent of no less than 2 miles N. by E. and S. by W., and the same distance east and west.

Over a considerable extent of the *Outer Owers* there are not more than 12 feet water; but there are only 2 to 3 feet over that part called the *Shoal of the Lead*, from which *Chichester* spire appears half way between *Pagham* church and a single tree, which is a remarkable object near the coast a short distance to the eastward of the church, N. $\frac{1}{4}$ E.; and *Mixon* beacon, N.N.W. $\frac{3}{4}$ W.

The *Elbow*, which is the outer or southern prong of the *Outer Owers*, lies S.S.W. nearly three-quarters of a mile from the *Shoal of the Lead*. As there are no good marks to define its position, great caution must be observed in approaching it, as it is steep-to, there being 30 fathoms water within a hundred yards of its extreme point.

Reclamation does not take place in the extreme case of water
the way, & but only in the case of the water part of the country
& points. Reclamation is carried out with a certain amount of land from
that part of the main drainage system in the form of the land there is no
additional payment.

As such it serves, unless the Vase is in the western extremity of the
chapel, as a secondary direction from Eastward to West and forms
the center & vocabulary of the composition.

Best results, consisting of growth and rest, is if comparatively recent formation, and carefully selected from the main body of the Outer Overs, may, for all practical purposes, be considered a part of that body. As this kind works in that issue is so low, it should be carefully avoided by removal of large quantities.

A conical buoy, painted black and white, with staff and cage, is placed a short distance seaward of the shoreward part of the bank, in $4\frac{1}{2}$ fathoms, but as $2\frac{1}{2}$ fathoms water will be found some distance outside the buoy, it should not be passed within a third of a mile. The marks for the buoy are: *St. Stephen's Church*, S. by W.; *Mixon Island*, N.W. by W., $4\frac{1}{10}$ miles; and *Crown Light-vessel*, S.S.W. $\frac{1}{2}$ W., 2 $\frac{1}{4}$ miles.

Although there are 26 feet water in the passage between East bank and Southwark head, the leading mark for which is Pagham watch-house in line with Chichester spire, bearing North, it should never be attempted by strangers.

OWERS LIGHT-VESSEL, moored in 19 fathoms water, S.S.E. half a mile from the elbow of the Outer Owers, exhibits at 38 feet above the sea a *flashed* white light, which should be visible in clear weather from a distance of 10 miles. The vessel has one mast, is painted red, with the word Owers on her sides, and carries a red ball at mast head; a gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger. From the vessel the east end of plantation on Bow hill is in a line with Pingham church, bearing North; Mixon beacon, N.N.W. $\frac{1}{4}$ W., $5\frac{1}{2}$ miles; East bank buoy N.N.W. $\frac{1}{2}$ E., $2\frac{1}{2}$ miles; and Nab light-vessel, N.W. $\frac{3}{4}$ W., $10\frac{1}{2}$ miles.

NOON MARK.—Outside the Owers, from the Boulder bank to a mile eastward of the Elbow, is an extensive field of rock with 7 to 9½ fathoms water over it, which presents to the mariner, by a close attention to the soundings, a most valuable warning of his approach to the Owers. Abreast the Houlder it runs off about 3 miles to the S.S.W., having 12 to 17 fathoms water inside it; but the deep water does not continue farther westward than the west end of the Boulder, its western limit being pretty accurately defined by the mark for clearing the Cross ledge.

To the eastward as the Outer Owers is approached, this bank narrows considerably, forming a sort of tail to the main body, and partially separated from it by a narrow swatch of rather deeper water ; this part is called the Hooe bank, which is 3 miles long, E.S.E. and W.N.W., and about a quarter of a mile broad, the outer part being nearly $1\frac{1}{2}$ miles from the Elbow. Bersted church in line with Goodwood, N. by E. $\frac{1}{2}$ E., leads eastward of the Hooe, as it does also of the East bank.

The least water on the Hooe is between 7 and 8 fathoms, with the Mixon beacon in line with Street watch-house ; and as little water as the above will occasionally be had on the western or large bank ; but the soundings within the Hooe range from 13 to 30 fathoms, the greater depth being near the south-western edge of the Elbow. The Hooe clearly shows itself by the overfall of the tide, which occasions a heavy broken sea, when running to windward in blowing weather.

The LOOE STREAM, lying as it does within the whole line of dangers, barred at its western entrance by turbulent overfalls, and having in many parts of it not more than 16 feet at low water, is only adapted for vessels of small draught, or by those possessing local knowledge, except under the most favourable circumstances. Great caution is also requisite not to be caught in it by night ; and the seaman should not take the passage except with a strong breeze and plenty of time before him to be certain of getting through in daylight, neither should a sailing vessel attempt it with an adverse tide.

Approaching the Looe from the westward, take care not to get too close in-shore ; and as the Cross ledge is approached, the Mixon beacon should not be brought to the northward of the Dries buoy, or Nelson monument must be well open of Hayling trees ; by neglecting some such precaution as this, a stranger is likely to get entangled with the Streets, and as the eastern stream sets strongly towards the Boulder bank, some caution is necessary in light winds.

Crossing the ledge, between the Dries and Pullar buoys, give the Dries buoy a sufficient berth, for there are only 11 feet water a quarter of a mile south of it ; and the nearer the Pullar buoy the better, but always leave it to the southward. If the Isle of Wight is tolerably clear, an excellent mark for leading over the Cross ledge and the whole way through the Looe in 14 feet water is, Little See-me-not just showing south of Culver cliff, bearing W. by N. $\frac{1}{2}$ N. The Pullar buoy on with Culver cliff, is a good line for leading through the Looe. When with Mixon beacon bears North or N. by W., the vessel may be considered as through the channel, and entering into that part of Pagham bay known as the Park.

Small vessels under favourable circumstances, and in fine weather, frequently work through the Looe. In standing to the southward do not

bring the Middle buoy to bear more easterly than S.E. by E., and in shooting over the Cross ledge contrive to pass near the Pullar buoy. When eastward of the Middle buoy do not attempt to pass it to the southward, until Kinnaird house is in one with the Clarence hotel at Bognor, N.E. $\frac{1}{4}$ N., which is one of the Swatchway marks.

On the north side of the channel, do not stand so far over as to get between the Dries buoy and the Mixon, for the rocks are high and dangerous; the buoy should not be brought to the westward of N.W. Abreast the beacon the rocks are steep-to, but still it will be better on account of the strong eddies to give it a moderate berth. To the eastward of the Mixon stand no farther northward than to have the beacon bearing West, which will ensure 15 feet at low water.

TIDES.—At Selsea bill it is high water full and change at 11h. 45m.; springs rise $16\frac{1}{2}$ feet, and neaps $12\frac{1}{2}$ feet. At the western entrance of the Looe, near Pullar buoy, the eastern stream makes at 3h. 45m., and the western stream at 10h. 0m., and they set S.E. and N.W. Between 2 and 3 miles outside Boulder bank, the stream turns about an hour later; the eastern stream running E.S.E., and the western stream West; and between Boulder bank and Middle Owers the streams run in the same directions. At the eastern entrance of the Looe, near Eastborough head, the eastern stream makes at 4h. 30m., and sets E. by N. $\frac{1}{2}$ N., and the western stream at 9h. 50m., and sets West. Off the west end of the Hooe bank, the eastern stream makes at 4h. 35m., and sets E.S.E., and the western stream at 10h. 30m., and sets W. $\frac{3}{4}$ N.

DIRECTIONS.—The course and distance from about 4 miles south of St. Catherine point to a similar position off Beachy head is E. by S., 59 miles. By pursuing this route a vessel will pass about 4 miles southward of the Owers light-vessel, and will not be materially affected by the indraught between the Isle of Wight and the Owers on either tide. After passing St. Catherine point, if the weather be thick, the shore should not be approached within the depth of 20 fathoms, by which precaution she will pass well outside the Owers and preserve the fair channel tide.

The soundings between the Isle of Wight and Cherbourg are irregular. The general quality of the bottom to the southward of the fairway is coarse, loose, or rocky; and the stones are generally covered with reddish incrustations. Within the distance of 15 miles of the coast of Hampshire and Sussex the soundings become finer, being chiefly sand mixed with fine gravel, which continues as far eastward as Beachy head.

The Owers light-vessel when seen will be a good guide either for passing south of the Owers, or for avoiding those dangers when turning to windward. A vessel will be westward of the Boulder bank when the west end of Medmery barn is in line with the spire of Chichester church, N.E. by N.;

abreast of the Middle Owers when Pagham church comes on with Rooks hill, N.N.E. ; and eastward of the Outer Owers and the East bank when Bersted church is in one with Goodwood, N. by E. $\frac{1}{2}$ E. In clear weather, the red clay cliff in Sandown bay, Isle of Wight, open south of Culver cliff, although a distant is a good mark, and will lead $1\frac{1}{2}$ miles south of the Boulder bank, and three-quarters of a mile south of the Outer Owers.

At night, the bearing of the Owers light and a careful attention to the lead will be the best safeguard when approaching these shoals. Steering to the eastward from Spithead, the Nab lights kept on a N.W. $\frac{1}{2}$ N. bearing astern, will lead about $2\frac{1}{2}$ miles south-west of the Boulder bank ; but if these lights are lost sight of before the Owers light is seen, take care to allow for the eastern stream, if it is running, as it will be on the vessel's beam, setting strong towards those dangers, especially after south-westerly gales. When the Owers light is sighted a course may be shaped to pass to the southward of her, but the light should on no account be brought to bear more southerly than S.E. by E.

Turning to windward between Beachy head and the Owers, do not stand into less than 10 fathoms (at low water), nor bring the Owers light to the southward of S.W. $\frac{1}{2}$ S. After passing any convenient distance to the southward of the light, by not bringing it more southerly than S.E. by E. will clear the shoals ; but this is a close mark for a large vessel, and it will be prudent not to stand into less than 10 fathoms, which will ensure being to the southward of the rocky banks, until the Nab lights are seen, when there can be no danger so long as they are not brought to the westward of N.W. $\frac{1}{2}$ W.

The depth of 10 fathoms is also a valuable guide for vessels between the Owers and Dunnose ; for by keeping outside it they may be assured of being clear of all danger as long as the Nab lights are to the northward of N.E. by N. ; after which St. Catherine light had better be kept in sight. If near the western end of the Boulder bank, and steering for the Nab during the western stream, a vessel will have it about two points abaft the beam ; and as it runs strong, particularly at springs, some allowance must be made, especially with a scant wind.

As the lead should invariably be kept going, and great attention paid to the soundings, certain intimation will be had when the rocky banks to the southward of the Owers are crossed, and the first deep cast afterwards in standing in must be the seaman's warning of his approach to the dangers. Attention is again drawn to the important fact, particularly in thick weather, that, failing to obtain a deep water cast, by which is understood over $9\frac{1}{2}$ or 10 fathoms, the seaman may be tolerably certain that his vessel is westward of the Boulder bank, and therefore great caution is requisite not to get embayed by standing in too far.

PAGHAM BAY.—From Selsea bill the coast turns abruptly N.E. $\frac{1}{2}$ N. for 3 miles, and then again as suddenly E. $\frac{1}{2}$ S., forming a deep bight called Pagham bay, at the bottom of which lies the entrance to Pagham harbour.

The shore from the bill to Pagham is a low shingle beach, and must be approached by vessels turning to windward with great caution, as the flats extend off at least 2 miles, where the depth is less than 3 fathoms. Near the Mixon these flats bend out to the southward, connecting Eastborough head with Selsea bill, and effectually bar the eastern entrance to the Looe at low water to vessels of heavy draught, but an ordinary attention to the lead will always give sufficient warning of approach to them. No landing can be effected at low water to the westward of Pagham harbour except near Selsea bill.

Pagham harbour is so completely choked up by ever shifting banks, that as a harbour it is utterly useless. Selsea church stands on the western side of the entrance, and Pagham church on the eastern; they are both useful sea marks, but the latter having the taller spire, is the more conspicuous. Sidlesham water-mill, easily recognized from the bay, stands with its face to the southward at the head of the harbour.

The coast to the eastward of Pagham changes its character to a low earthy bank rapidly crumbling away by the encroachment of the sea, with a flat and highly cultivated country at the back. Pagham coast-guard dwellings and watch-houses are useful and distinct objects from the sea, and stand a short distance eastward of the harbour. Nye Timber wind-mill may also be seen a little north of the watch-house.

The PARK.—The anchorage in Pagham bay between the Owers and the coast is familiar to seamen under the name of the Park, which is well sheltered from the violence of West and S.W., winds, but most unsafe with the wind anything to the eastward of South. The holding ground is excellent, being a stiff clay under a thin crust of gravel; but the anchorage cannot be recommended as a refuge for large vessels owing to the frequent and sudden shifts of wind, and the astonishing rapidity with which the sea gets up. The above observation is particularly applicable during the winter months, for a long dreary night in the Park is anything but desirable.

Small vessels anchor with the Mixon beacon bearing W.S.W., and Pagham watch-house on with Chichester spire, in about 3 fathoms at low water; but vessels of large draught should anchor farther out and more to the eastward, with the spire to the westward of Bow hill, and the Mixon beacon W. by N., both for greater depth of water and increased facility of getting away from the coast, in the event of being surprised by a shift of wind. The nearer the Mixon is approached, the stronger the tides.

BOGNOR, a fashionable watering place of some extent, shows conspicuously from the sea in every direction. Felpham white mill stands close to the edge of the coast, about half a mile eastward of the town, and forms a valuable sea mark. The venerable little church of Felpham may also be seen about half a mile at the back of the mill, and having no spire is distinguished from Bersted church, which stands about a mile westward of it; during the summer it is nearly hid by the trees.

TIDES.—It is high water, full and change, on the shore near the entrance of Pagham harbour, at 11h. 30m.; springs rise $16\frac{1}{2}$ feet, and neaps $12\frac{1}{2}$ feet. At Bognor it is high water at the same time; springs rise $17\frac{1}{4}$ feet, and neaps $14\frac{1}{4}$ feet. In the Park the eastern stream makes at 4h. 5m., and sets East, and the western stream at 9h. 50m., and sets for the first three hours West; between the 3d and 4th hours it slackens, and runs from W.S.W. to S.W. by S., gradually trending to the southward until the eastern stream makes; the velocity never exceeds $1\frac{1}{2}$ knots.

The COAST from Bognor to Worthing is low, not being much above the high-water level of the sea. The principal objects are, the large white mill at Felpham; Middleton church spire; Climping large black mill; the harbour mill and Beach town at Little Hampton; Preston church spire showing above the trees; Highdown hill, on the face of which are three chalk pits and a black mill on its western slope; Goring church, with its black spire; Salvington mill on the hills in the back land; and Cisebury hill to the northward of Worthing; all the foregoing, with the town of Worthing, standing close to the beach, form conspicuous objects from seaward. At 5 miles N.N.E. of Worthing is Chanctonbury ring, a large thick circular grove of trees 964 feet above the sea, which is frequently the first object seen on making the land. A reference to this object would often assist the mariner when all others are too low or indistinct to be observed.

The coast about Shoreham is low, showing a deep valley of the river Adur, between Shoreham and Lancing; but Lancing circular grove, Lancing white mill, the town of Shoreham, the high coke chimney near Shoreham harbour, Copperas and Portslade mills, and the town of Brighton are objects easily recognized.

From Brighton to Newhaven the coast is composed of chalk cliffs, varying from 30 to 170 feet in height, the summits of which are clothed with verdure. The village of Rottingdean lies in one of the valleys about $1\frac{3}{4}$ miles S.E. by E. of the eastern part of Brighton; and on the western side of the downs adjoining Rottingdean is a large black mill, which is conspicuous from seaward. Burrow head—the eastern cliff on this range—is about 190 feet high, with a flagstaff upon it; the upper portion of the head is composed of earth, and the lower part chalk, but the wash from

the earthy part gives its face a rusty appearance. Close to the eastward of Burrow head is the harbour of Newhaven.

The shore from Newhaven harbour to Seaford head is composed of low beach, on the western part of which stands a large yellow building known as Catt's tide mill; near the eastern part is the village of Seaford, conspicuous by its square tower church, and the spire of Blatchington church, which stands a little farther inland, also the mortella tower on the beach near the low north-west point of Seaford head. The high land at the back of Seaford and Newhaven is a continuation of the range of hills from Beachy head, known as the South Downs.

Seaford head, 270 feet high, is generally of a rusty white appearance, having a large green patch on its face near the top, by which it may be known from Beachy head, which has always a clean white face and is surmounted by a house. To the south-east of Seaford head is the valley of Cuckmere, where was formerly a haven for ships, but through which only a small stream now runs; and between this and Beachy head is a range of undulating cliffs, known as the Seven Sisters, which are distinctive features in the appearance of Beachy head when seen from the westward.

The principal dangers between the Owers and Beachy head are, the Bognor, the Shelly the Winter, and the Jenny Ground rocks, which are close to the shore, and the Kingmere rocks, which lie about $4\frac{1}{2}$ miles from the coast between Little Hampton and Worthing.

A Life Boat is stationed at Worthing.

Bognor Rocks form a high and dangerous ledge, extending in a south-east direction for at least $1\frac{1}{4}$ miles off shore a little westward of the town of Bognor; they dry some time before low water in large detached blocks of conglomerate or pudding stone, and are bold on their sea face. Their outer end, Bognor spit, is a mile from the shore, and dries at five hours ebb, with 13 to 17 feet water on its north-east side; the marks for the spit are, Pagham church and watch-house in line N.W. by W. $\frac{3}{4}$ W., and Felpham church open eastward of the two mills. Pagham watch-house open north of Pagham church N.W. by W. $\frac{1}{4}$ W. leads a quarter of a mile south of the ledge, and Felpham white mill in one with a grove east of Rooks hill, North, leads to the eastward; Middleton church spire on with Arundel church turret (white) leads south-east of the spit.

The Barn rocks lie about a mile westward of the Bognor rocks, and uncover at low water; but as they are close inshore, they are not at all dangerous except for boats.

ANCHORAGE.—The anchorage in-shore, on the north-east side of the Bognor rocks, not recommended for general use, on account of there

being no outlet if caught with south-east winds, which bring a heavy sea. It is however used by small coasters chartered for Felpham and Bognor, and might also be used by vessels of small draught when not able to get as far as the Park with strong westerly winds.

After rounding Bognor spit, steer for the shore to the westward of Felpham white mill, and anchor when Pagham church opens north of the coast-guard houses; or when Bognor church tower is seen just westward of a large white house near the beach, and Arundel church tower opens westward of a large clump of trees.

Middleton Ledge is a low straggling ledge of rocks projecting a short distance outside the general line of low-water mark at spring tides, about midway between Felpham mills and Middleton church. Climbing mill in line with the coast-guard staff at Elmer leads on them. The ledge extends in a S.S.E. direction, with 4 to 6 feet water over it towards the Shelley rocks, and between it and the Shelley is a passage of 11 feet water; but no vessel drawing more than 9 feet should navigate at low tide inshore of the Shelley or Winter rocks.

Shelley Rocks lie $1\frac{1}{2}$ miles S.S.E. of Felpham mills, and have only 4 to 6 feet water over them in detached patches. From the outer or south-east patch Middleton church spire is in line with the east end of a conspicuous long barn N.N.E. $\frac{1}{4}$ E.; and the middle chalk pit on Highdown hill is on with the left of the two Rustington mills.

A black conical buoy is placed on the south-east side of the rocks in 4 fathoms, with Arundel church tower on with coast-guard house at Elmer, N.E. $\frac{1}{4}$ N.; Chichester spire in line with Felpham station-house, N.W. by N.; and East bank buoy, S.W. $\frac{1}{4}$ S., $4\frac{7}{10}$ miles. Felpham square black mill just open west of the circular white mill N. by W. $\frac{1}{2}$ W., leads westward in 3 fathoms; and Felpham mills in line with Rooks hill, N. $\frac{3}{4}$ W., leads to the anchorage on the north-east side of the Bognor rocks, in a fairway between the Bognor spit and the Shelley rocks.

Winter Knoll is a small bank of chalk, with only 8 feet water on it, lying off the coast-guard station at Elmer, about S.W. by W. $2\frac{1}{2}$ miles from Little Hampton lighthouse. From the shoalest spot of 8 feet, Arundel church is in line with the middle of the eastern of two gaps in the park trees, N.E. by N.; and Cisebury hill appears over the top of Highdown hill, E. by N. $\frac{1}{4}$ N.

A black can buoy is placed off the south side of this shoal, in 3 fathoms water, with Dome house at Bognor its width north of Felpham black mill, N.W. $\frac{1}{4}$ W.; Little Hampton pier light-house N.E. $\frac{1}{4}$ E.; and Shelley buoy W. by N. $\frac{1}{2}$ N., distant $1\frac{3}{4}$ miles. Salvington mill in line with the chalk pit on Highdown hill E. by N. $\frac{1}{2}$ N. leads south of the knoll.

Kingmere Rocks lie $4\frac{1}{2}$ miles off shore, S.S.W. from Highdown and Preston church, and have from $4\frac{1}{2}$ to $5\frac{1}{2}$ fathoms water over them. They cover a space 2 miles long, N.W. by W. and S.E. by E., and are very narrow; between them and the flats which extend off shore there is a general depth of $5\frac{1}{2}$ and 6 fathoms, with occasional patches of $3\frac{3}{4}$ fathoms. Chanctonbury grove open westward of Salvington mill, and Goring church (black spire) N.E., leads over their western end in 29 feet water, and Navarino mills between Lancing grove and mill N.E. by E., leads over their eastern end in 33 feet; Chichester church spire over the north part of Felpham trees, leads over their north-western part in 29 feet, and to the southward of their eastern end in $7\frac{1}{2}$ fathoms.

LITTLE HAMPTON.—Nearly 5 miles to the eastward of Bognor, and N.W. by W. $\frac{1}{4}$ W., 28 miles from Beachy head light, is the entrance of the river Arun, between two piers 125 feet apart. The western pier is carried out 200 yards farther than the eastern one, by which the beach and sand which works up from the westward is accumulated and prevented from washing into the entrance. In continuation of the east pier is a low dicker-work, which is carried above the level of the sands, and extends nearly out to low-water mark; this serves to guide the stream in a fairway out, so as to scour the entrance and carry the *débris* as far seaward as possible, to prevent the formation of a bar. A row of warping posts is driven into the sand at 20 feet eastward of the dicker-work; the outer three posts are outside the low work, the termination of which on both sides is marked by a bush beacon.*

The depths within the entrance at high water springs are :—16 feet in the fairway off the warping post, 15 feet abreast the bush beacon on the end of the low western work; 17 feet between the piers, 16 feet abreast the mill, and a general depth of 18 to 16 feet up to the ferry at the north-western part of the town of Little Hampton. A vessel drawing 13 or 14 feet water can proceed up to Arundel, there being a towing-path on the port hand, and several berthing piles should she be obliged to stop for tide.

Little Hampton is about three-quarters of a mile within the entrance of the Arun, and was the ancient haven of Arundel. On the western shore, there is a ship yard and a patent slip; the latter being 400 feet long, and capable of receiving a ship of 400 tons burthen, and of 10 feet draught. The number of vessels belonging to the port is 36, amounting to 5,490 tons.

LIGHTS.—A *fixed red* light is shown all night on the north end of the east pier at the entrance of the Arun. It is elevated 30 feet above high water, and visible in clear weather from a distance of 7 miles.

* See Admiralty plan of Entrance to the River Arun, No. 13; scale, $m = 5\frac{1}{2}$ inches.

The following lights are placed on the south end of the east pier to show the depth of water, and when in one with the above red light bearing North lead to the entrance. A white light indicates 10 feet between the piers; a green light, 11 feet; a red light, 12 feet; a red and white light, perpendicular, 13 feet; two white lights, perpendicular, 14 feet; and a white and green light, perpendicular, 15 feet. These lights are extinguished at high water.

ANCHORAGE.—Vessels drawing less than 10 feet will find good anchorage in the 2-fathom hole off Little Hampton, with the Outer warping post in one with the mill near the harbour N. $\frac{3}{4}$ E., and Cisebury hill opening southward of the crest of Highdown hill; or at a mile from the piers in 13 feet water, chalk and gravel, with Salvington mill in line with the chalk pit of Highdown.

If the vessel is of 17 feet draught, anchor with the entrance open about $1\frac{1}{2}$ miles distant, and Chanctonbury grove over the western chalk pit on Highdown, in 19 or 20 feet water, chalk, stones, and gravel.

There is a position farther westward much approved of by the pilots, with Little Hampton church in line with the coast-guard houses east of the harbour mill, or the mill open west of the lighthouse; and the Winter buoy W. by N. distant one mile. Should a vessel require to anchor before going into the river, it would be advisable, if the wind be easterly, to anchor off Rustington mills, as the stream will set to the westward by the time there is water to enter.

TIDES.—At Little Hampton it is high water, full and change, at 11h. 36m.; springs rise 16 feet, and neaps $11\frac{1}{2}$ feet. The general depths over the bar are $14\frac{1}{2}$ to $15\frac{1}{2}$ feet at high water springs, and $9\frac{1}{2}$ to 11 feet at neaps. At Arundel it is high water at 12h. 25m. The stream in the river depends upon the state of the country; thus, after heavy rains there will be a constant downward current.

The flood runs with great strength until one hour after high water; but immediately outside the eastern pier-head, from half flood to half ebb, it sets strongly to the westward, and this must be carefully attended to, when going in or out, in order to avoid the western jetty work.

The tidal signals are made from a signal staff near the lighthouse. They are exactly similar to those used at New Shoreham, page 208, and give the depth in feet at the entrance.

DIRECTIONS.—Approach the entrance of the Arun with the outer warping post in one with the lighthouse bearing North, and keep about a ship's length westward of the outer posts, taking care to be to the westward of the bush on the end of the low work and to make allowance for the stream, which sets about $2\frac{1}{2}$ knots to the westward at half tide, and strong

(nearly 6 knots) up the harbour between the piers. After passing Mussel row, the tide slackens, and when near the berthing place it is customary to let go the anchor and warp into a berth. Pilots are always in attendance and provided with fine boats, so that the weather must be bad when they cannot come off.

Grass Banks, which extend along the coast off Worthing, are so named from the great quantity of long grass that grows on the chalk and gravelly soil of which the bottom is composed. They have as little as 9 feet over them at $1\frac{1}{2}$ miles from the shore, and their most projecting part, called the Elbow, bears S.S.E. from Navarino mills and S.S.W. from Lancing grove, and their eastern side terminates about a mile westward of the black coast-guard buildings at Shoreham.

When sailing along shore from the eastward keep the lead going, and do not stand nearer the Elbow than to have Portslade mill coming on with Shoreham piers—the mill on with the low lighthouse at Shoreham leads outside the Elbow in 12 feet at low water. When Lancing grove is in one with the coast-guard houses N.N.E., a course more to the northward may be kept; but when working to windward the lead is by far the best guide.

NEW SHOREHAM HARBOUR offers considerable advantages to wind-bound vessels to run for shelter at a proper time of tide, being about midway between the Isle of Wight and Dungeness. From recent improvements it is capable of taking vessels of considerable burthen at all tides at high water, the entrance being wide, with a depth of 21 feet between the piers, and in the harbour at high water springs, and 15 feet at high water neaps.*

The harbour is formed by the outset of the river Adur, which flows through the beach between two piers, 176 feet apart, which form the entrance. Within these piers a third or middle pier is built out from the shore, for the purpose of directing the waters on the ebb directly to the entrance, and it divides the harbour into two parts, called the eastern and western arms. The western arm is the natural one formed by the course of the river; the eastern arm is partly artificial and partly formed by the original course of the river, which then emptied itself into the sea a mile eastward of the present entrance. There is a patent slip in each arm; the one in the western arm is capable of receiving a vessel of 600 to 700 tons burthen, and the other in the eastern arm of about 300 tons.

The western arm has $20\frac{1}{2}$ feet in it at high water springs, and 15 feet at high water neaps, and vessels drawing not more than 7 feet can lie afloat at low water springs. There are good wharves, which are chiefly used by

* See Admiralty plan of Shoreham Harbour, No. 12; scale, $\frac{1}{2}$ inch = 6 inches.

colliers and timber laden ships. The bed of the river between the wharves and the town is uneven and hard; at the town the bed is 5 feet above the level of low water ordinary springs. At the Custom-house quay there are $11\frac{1}{2}$ feet at high water springs.

The eastern arm, between the middle pier and the entrance lock of the floating canal, has $17\frac{1}{2}$ feet in it at high water springs, and 12 feet at neaps. The canal is $1\frac{1}{2}$ miles long, and has 16 feet water in it at high water springs, and 11 feet at neaps. The lock is 175 feet long, 33 feet wide, and the sills have $21\frac{1}{2}$ feet over them at high and 5 feet at low water springs; and 16 feet at high and 8 feet at low water neaps. Vessels drawing 15 feet can lie afloat inside the lock.

A horn or breakwater is constructed near the west side of the western pier, for the purpose of diverting the travelling shingle from forming a bar at the entrance; and vessels taking the harbour must be careful not to mistake the end of this breakwater for the western pier head.

The total number of vessels belonging to the port in 1868 was 167, and their tonnage 33,881 tons. During that period 354 vessels and 29,209 tons entered inwards from foreign, and 518 and 73,224 tons coastwise; 315 vessels and 24,448 tons cleared outwards for foreign, and 60 vessels and 3,729 tons coastwise. The population of the parish of New Shoreham in 1868 amounted to about 4,000.

LIGHTS.—Two lights are exhibited at 42 and 23 feet respectively above high water, from the lighthouses within the entrance of harbour; they bear N.N.E. and S.S.W. from each other, and are 250 yards apart. The high lighthouse, of gray stone and 38 feet high, stands on the shore, and exhibits, from sunset to sunrise, a *fixed* white light visible at 10 miles. The low lighthouse, built of wood and painted white, stands near the apex of the middle pier, and also exhibits a *fixed* white light during the time a vessel drawing 11 feet water can enter the harbour with safety, and a *red* shade is put over it when it is high water and slack tide.

On the low lighthouse is a flagstaff, on which a red flag is hoisted during the day, when a vessel drawing 11 feet can enter the harbour with safety, and at high water slack it is hauled half-staff down.

Church Rocks lie half a mile westward of the black coast-guard buildings at Shoreham, or two-thirds of the way from them towards the groynes on the beach, and one-third of a mile off shore; they have 3 feet water on them, but they have been seen dry by some of the inhabitants of Shoreham. The marks for the rocks are, the cement chimney in one with the roof of Shoreham church, and Lancing mill over the two easternmost groynes on the beach. Fishers-gate mill (circular and gray) just open of Shoreham harbour piers, E. $\frac{1}{2}$ S., leads to the southward in 14 feet water.

Jenny Ground is a cluster of chalk rocks, with 5 to 7 feet water, extending half a mile off shore abreast the white square mill of Copperas, which stands on the low cliffs near the eastern arm of Shoreham harbour. The marks for the outer part of 7 feet water are, Copperas and Portslade mills in one, N.N.E., and Shoreham church shut over the piers. Shoreham church on with Lancing grove and open south of the white pier heads, bearing N.W., the church spire in the eastern part of Brighton shut in with the old chain pier, E. by N. $\frac{3}{4}$ N., leads to the southward.

ANCHORAGE.—A vessel may anchor in any convenient depth off New Shoreham, from a third of a mile off the harbour in 16 feet water, to one mile in 24 feet water, over sand and gravel with patches of chalk, or westward of the Jenny Ground rocks, with Shoreham church and Lancing grove in one, in 3 fathoms, sand, shells, and mud. Should it be necessary to wait any length of time for sufficient water to go into the harbour, anchor off the black coast-guard buildings, with Shoreham church bearing North, and Portslade mill between the low lighthouse and the pier heads, in $3\frac{1}{2}$ fathoms. This anchorage is sheltered from westerly winds by the shallows off Worthing, and has the advantage of having an easy stream on the flood.

TIDES and TIDAL SIGNALS.—It is high water, full and change, in New Shoreham harbour at 11h. 34m.; springs rise 18 feet, and neaps $13\frac{1}{4}$ feet. The stream on both tides runs with great force between the piers, often as much as 6 knots; on the flood it is split by the middle pier, and its force diminished in each arm.

Near the low lighthouse on the middle pier is a flagstaff and yard, on which the following tidal signals are made with black balls two feet in diameter and a blue and white pendant.*

SIGNALS.		SIGNIFICATION.		
A single ball at masthead	-	-	General answer or acknowledgment.	
Two balls " "	-	-	There are 8 feet water on bar with flowing tide.	
Three balls " "	-	-	9	" " "
One ball at outer yard arm	-	-	10	" " "
Two balls " "	-	-	11	" " "
Three balls " "	-	-	12	" " "
One ball at inner yard arm	-	-	13	" " "
Two balls " "	-	-	14	" " "
Three balls " "	-	-	15	" " "
A single ball at each yard arm	-	-	16	" " "
A pendant at mast head	-	-	It is now slack tide.	
" and one ball under at masthead.	-	-	16 feet on bar with an ebbing tide.	
" and two balls under at masthead.	-	-	15	" " "
" at masthead, and one ball at outer yard arm.	-	-	14	" " "
" and two balls at ditto	-	-	13	" " "
" and three balls at ditto	-	-	12	" " "
" and one ball at inner yard arm.	-	-	11	" " "

* The same tidal signals are used at Little Hampton.

SIGNALS.		SIGNIFICATION.	
A pendant and two balls at inner yard arm.	-	10 feet on bar with an ebbing tide.	
" and three balls at ditto -	- 9	" " "	
" at outer yard arm -	- 8	" " "	
" and one ball under at ditto		There is not water enough on bar.	
" and two balls under at ditto		Keep eastward.	
" between two balls at ditto		Keep westward.	
" under one ball at ditto -		The signal cannot be made out, the flag is foul or hid by upper sails.	
" under two balls at ditto -		The depth of water will be shown at every foot rise or fall.	
" at inner yard arm -		Assistance will be sent immediately.	
" with one ball under at ditto		Pilots cannot get to sea.	
" with two balls under at do.		Pilots will be sent when a boat can pass the bar.	
One ball with pendant under, at inner yard arm.		Pilots are all engaged, but one will be sent as soon as possible.	
Two balls ditto ditto -		The owner wishes his vessel to bear up for shelter.	
" at outer and one ball at inner yard arm.		The owner does not wish his vessel to risk the bar.	
One ball at outer, and two balls at inner yard arm.		Pilots will be on the pier, if the vessel attempts the bar the depth of water will be shown.	
Two balls at masthead, and one ball at outer yard arm.		It appears a vessel might stem the tide.	
Ditto ditto inner yard arm -		The tide runs so strong that a vessel may not be able to stem the tide.	
One ball at masthead, with pendant under.		The tide is ebbing.	
Two balls ditto ditto -		The tide is flowing.	

DIRECTIONS.—Vessels bound to New Shoreham from the westward, after passing Worthing, will open a deep valley, having on its east side Shoreham church, which may be seen some distance at sea; it has a square tower, its roof appears white, and it stands about a mile westward of the piers. Approaching from the eastward, the Jenny Ground rocks will be avoided by keeping New Shoreham church open south of the pier heads, N.W.; at night do not approach the shore within the depth of 5 fathoms at low tide, until the high light bears N.N.W.

Vessels turning to windward from the eastward, between Newhaven and Shoreham, will, by keeping inshore, find a stream setting to the westward nearly 2 hours before it is high water on the shore, and by making short tacks, they will get to the westward before the offing stream has made down Channel.

As the tides run strong at the entrance to the harbour, the best time to enter is at high water slack. The two lighthouses in one N.N.E. will lead midway between the outer pier heads, but either by night or day be careful to allow for the stream, just noticed, setting to the westward. When inside the outer piers borrow on whichever side or arm the vessel is bound to, to avoid being set by the stream against the middle pier, where some serious accidents have occurred. In the western arm, buoys are moored abreast the wharves, on the top edge of a steep bank, and it is customary to make fast to a buoy, or run the vessel's fore foot on the bank, or drop the anchor and let the flood stream swing her stern round, and then warp into a berth.

A Life Boat is stationed at New Shoreham.

BRIGHTON.—The centre of this fashionable watering place is about 4 miles S.E. by E. from Shoreham. The houses fronting the sea present an almost continuous line of handsome buildings for a distance of 3 miles ; and though no manufactures are carried on, the prosperity of the town may be estimated from the fact that in half a century the population has been quadrupled. In 1861 the population amounted to 87,317.

Pier Lights.—A magnificent pier, lately constructed, extends 1,115 feet into the sea, and at its head, which is 140 feet broad, is displayed a *fixed red* light, which should be visible in clear weather from a distance of 5 miles.

A mile to the eastward of the above pier is the old chain pier, which extends 1,100 feet from high water mark, and at its outer end, from an elevation of 35 feet, is exhibited a *fixed green* light, which should be visible from a distance of 10 miles.

TIDES.—At Brighton it is high water on full and change days at 11h. 15m. ; springs rise 19½ feet, and neaps 16 feet. As before stated, the stream inshore sets to the westward about 2 hours before it is high water by the shore.

A Life Boat is stationed at Brighton.

Black Rock Ledge extends a quarter of a mile from the cliffs at low water springs, off the eastern part of the town of Brighton, abreast the Black rock coast-guard station. The ground is shoal for a quarter of a mile outside the ledge, which must be approached with caution when the tide is low. Beachy head lighthouse open of Seaford cliff leads outside the shallows in 3 fathoms, and when the tide flows over the ledge it is difficult to estimate the distance off shore ; but the pier end shut in with the western houses in Brighton will clear the dry part of the ledge, about cable's length.

The whole of the coast between Brighton and Newhaven is studded with chalk rocks in detached patches on a sandy strand, but the depths alongshore are regular. Beachy head light just shut in by Seaford cliff will lead outside all the patches in depths varying from 8 to 14 feet, and if kept a quarter of a point open, it makes a good working mark ; the best guide however is the lead.

Fricker Rocks are detached from the low-water rocks off Burrow head, and uncover 10 feet at low water. They lie nearly 1½ cables off the cliffs, and afford shelter to the entrance of Newhaven harbour, from which they are distant a quarter of a mile. These and the shallows off the harbour are cleared in 16 feet water by keeping Blatchington church spire, over the low cliffs, between the Buckle inn and the long row of white coast-guard buildings near the battery.

NEWHAVEN HARBOUR, lying about midway between Spithead and the Downs, and in the fair track of vessels working up or down channel, is the best tidal harbour between Portsmouth and Ramsgate, having a 20 feet rise of tide, and a powerful backwater. The entrance is in the north-west extreme of Seaford bay, close to the eastward of Burrow head, the last of the range of chalk cliffs eastward of Brighton.

The harbour is formed at the entrance of the river Ouse by conducting the channel of that river into the sea in a southerly direction from the town of Newhaven, which stands on its right bank nearly a mile above the pier heads. At the town there is a swing bridge to allow vessels of 36 feet beam to pass through when bound to Lewes, the river being navigable to that place for small coal brigs. Above the bridge there is a ship yard for building and repairing ships. In 1866, there belonged to the port 158 sailing vessels, representing 30,000 tons. In 1861, the population of the town amounted to 1,813.*

The piers at the entrance are 150 feet apart, and are constructed of strong wood piles carried out in a southerly direction across the beach. The western pier is about 210 yards long, and the eastern pier about 167 yards, the inner end of the latter being in line with the high ridge of beach above high water mark. Within this, on the western side, the western pier is continued up the harbour by a well-built stone embankment, which terminates at the sea wall near the watch-house opposite the railway hotel.

Two wooden lighthouses of unequal height stand near the middle of the western pier, about 230 feet within the entrance, and there is another, about 14 feet high and painted stone colour, abreast them on the eastern pier. Near the hotel there is a good wharf, whence steamers run to Dieppe and Jersey. There is also a strong gridiron, capable of taking a vessel of 600 tons burthen, and 200 feet long. On the western shore, from the watch-house to the bridge, are twenty sets of berthing piles, alongside which vessels ground on soft mud.

A high groyne or breakwater has been run out in a S.W. by S. direction, at a short distance westward of the west pier, to accumulate the shingle and prevent the shifting bar from forming, which before was so detrimental to the harbour; it also splits the sea in strong westerly gales, so that vessels enter easily between the piers. The only bar now existing is one of compact shingle or pudding stone, which runs across the entrance at 250 feet outside the piers, and thence a flat extends seaward, there being a depth of 6 feet about $1\frac{1}{2}$ cables from the pier heads. A red warping buoy is moored S. by E. half a cable's length of the east pier head. There are capstans on each pier.

* See Admiralty plan of Newhaven Harbour, No. 2,154; scale, $m = 18$ inches.

The bar is nearly awash at low water ordinary springs, whilst between the piers there are 7 feet water, and thence to the bridge the soundings vary from 6 to 4 feet. The depths over the bar are always a few inches more than the actual rise of tide; they are indicated by the signals made from the flagstaff on the western pier by day, and by the lights at night, but in crossing it will be necessary to allow for the heave of the sea. For 8 to 10 feet water over the bar one black ball is hoisted on the flagstaff; and for 10 to 13 feet two black balls. At 13 feet the balls are lowered and a red flag is hoisted and kept up when upwards of 13 feet and until the tide has ebbed to 13 feet; from 13 to 10 feet two balls are hoisted, and from 10 to 8 feet one ball.

LIGHTS.—Two *fixed* lights, 28 and 17 feet respectively above high water, are exhibited from the lighthouses on the western pier at Newhaven, and when in one bear N. $\frac{1}{2}$ W. and S. $\frac{1}{2}$ E. about 50 yards apart. The high light is *white*, and shown all night; the low light is *red* when there are between 10 and 13 feet water on the bar, and *white* above 13 feet till the tide ebbs again to that level; from 13 to 10 feet water it is again *red*. The high light should be seen from a distance of 10 miles.

To assist vessels entering between the piers, a *fixed green* light is shown all night from the lighthouse on the eastern pier. The light is elevated 18 feet above high water, and visible at 3 miles.

TIDES.—At Newhaven it is high water, full and change, at 11h. 51m.; springs rise 20 feet, and neaps 15 feet. About $1\frac{1}{2}$ hours before high water, the stream begins to set to the westward close in shore, but is so weak across the harbour entrance that it is of no consequence excepting to a sailing vessel with a light wind. Between the piers the stream, being contracted, runs about $2\frac{1}{2}$ knots on both tides, diminishing in force as the harbour widens.

DIRECTIONS.—When coming from Beachy head towards Newhaven, observe the rocks off Crowlink (on the Seven Sisters), and if they are awash or covered, it will indicate a depth of 10 feet water and upwards over the bar. Run towards Burrow head, and when nearing the piers bring them to bear North with the harbour open, and passing westward of the red buoy outside the entrance, steer between the piers, whence a N. $\frac{1}{2}$ E. course leads up the harbour. When far enough up anchor, or run out a warp to the berthing piles or stage, and drop into a berth.

At night observe the depths by the lights, and run in with them in one bearing N. $\frac{1}{2}$ W., until well up to the western pier, when open the harbour and proceed up between the piers.

On the strength of the ebb, the harbour is by no means easy of access, and formerly the signals were never shown on the falling tide; but since

the passage steamers have used the harbour it has been deemed necessary to have signals as long as there is water enough for them to cross the bar. The gaslights at Brighton greatly assist in making the entrance at night.

A Life Boat is stationed at Newhaven.

SEAFORD ROAD.—Between Shoreham and Beachy head the soundings gradually decrease from the offing towards the land, and vessels may anchor all along the coast with off-shore winds in from 2 to 9 fathoms water; but the anchorage of most general resort is that in Seaford road, between Catt's tide mill, which stands on the shore eastward of Newhaven, and the mortella tower on the beach at Seaford. The best anchorage in the road is between this tower and Blatchington battery, with Beachy head lighthouse just shut in by the cliffs, in about 7 fathoms, over a bottom of sand, shells, and mud. In this position Beachy head cliffs will afford shelter with the wind as far southerly as E.S.E., and it is therefore superior to the West bay of Dungeness.

SEAFORD HEAD is often mistaken for Beachy head by vessels coming up Channel when within 4 or 5 miles of the land; they may however be distinguished by there being a small building on the highest part of Beachy head, whereas there is nothing on the former but a large and conspicuous green patch on the face of the cliff. Some straggling chalk rocks, named the Henston, with 2 to 4 feet water on them, lie a quarter of a mile off the low north-west end of Seaford head, with Blatchington church spire and mill just open eastward of the mortella tower on Seaford beach. Newhaven mill on with the pier heads, or Crowlink coast-guard houses open of the south-east cliff of Seaford head, leads to the southward in $3\frac{1}{2}$ fathoms.

BEACHY HEAD.—This promontory, 550 feet high, bearing E. by S. $\frac{1}{4}$ S. 34 miles from the Owers light-vessel, is rendered strikingly remarkable when seen from the westward by the uniform convexity in the profile of its seven white cliffs, generally called the Seven Sisters; when seen 15 miles off in an E.S.E. direction, it makes like an island, the left side being chalk cliffs, with a house on it, and the middle and right side covered with verdure, terminating in the bluff of the South downs.*

LIGHT.—Beachy head lighthouse, 47 feet high and coloured white, stands on a spot 242 feet above high water called Belle Toute, near the summit of the second cliff westward of the head. It exhibits a white light, which *revolves* once in every *two minutes*; its brilliancy being of 15 seconds duration, and its darkness one minute and 45 seconds. The light

* See Admiralty chart :—Beachy Head to Dungeness, No. 2,452; scale *m* = half an inch.

is elevated 265 feet above high water, and is visible in clear weather from a distance of 23 miles.

Coming from the eastward the light will open of the head on a N.W. $\frac{3}{4}$ W. bearing, and by keeping it so, it will lead $1\frac{1}{4}$ miles outside the southern head of the Royal Sovereign shoals.

THE COAST from Beachy head towards Pevensey trends deeply inwards and the land here is but little above the level of the sea ; towards Hastings it again becomes elevated, and the land appears double, rising high in the interior. Between Beachy head and Fairlight the strand, on which are a great number of mortella towers, is composed of coarse shingle studded here and there with small rocky heads, particularly in the vicinity of Hastings and Cliffs-end point. Fairlight down is the highest land hereabouts, and often the first land-fall made by vessels homeward bound. It may always be known by two conspicuous objects on it, viz., the high mill, 626 feet, and the church—which has a square stone tower—597 feet, above high water. The summit of the down is green pasture land, and the face of the cliff a gray sandstone.

ROYAL SOVEREIGN SHOALS are a number of rocky banks lying directly in the track of vessels proceeding between Beachy head and Dungeness. The principal are known as the Royal Sovereign, Horse of Willingdon, Elphic Tree, Long Shoal, and Southern head. There are strong rippings over the shoals during spring tides, and in bad weather the sea breaks heavily upon them.

The Royal Sovereign, so called from a ship of that name having grounded on it in 1756, is composed of sandstone rocks, and has only 9 feet water on its shoalest part, from which the signal house on Beachy head bears W. by N. $\frac{3}{4}$ N., distant $6\frac{1}{2}$ miles ; the first tower standing eastward of the Grand redoubt at Eastbourne is in one with the western edge of Willingdon chalk-pit, N.W. $\frac{1}{4}$ N., and Fairlight mill is just seen opening of Hastings castle cliff, N.E. by E. $\frac{1}{2}$ E.

A large buoy, striped black and white vertically, with staff and cage, is moored half a cable southward of the 9-feet patch, with the following marks :—The first mortella tower eastward of Eastbourne in line with the west side of Willingdon chalk-pit, N.W. $\frac{1}{4}$ N. ; the white mill north of Bexhill a little open westward of the third mortella tower west of Bexhill cliff, N.E. by N. ; Fairlight mill just open southward of Hastings castle cliff, N.E. by E. $\frac{1}{2}$ E. ; and Beachy head, W. by N. $\frac{1}{2}$ N.

The Southern Head is a small narrow ridge, about a third of a mile long, N.N.E. and S.S.W., with 25 feet water, lying S. $\frac{1}{2}$ W. $1\frac{1}{2}$ miles from the Royal Sovereign shoal. From the shoalest part, Beachy head signal-house bears N.W. by W. $\frac{1}{4}$ W., distant 7 miles, and Hankham mill is in

line with the eighth tower eastward of Eastbourne, or the fourth from Langley fort, N. by W. $\frac{1}{2}$ W.

Close to the southern edge of this shoal there are 8 fathoms water, to the eastward 11 fathoms, and between it and the Royal Sovereign 5 to 10 fathoms. There are 10 fathoms at half a mile to the southward of it, and at a mile in the same direction Beachy head light will open out, bearing N.W., $\frac{3}{4}$ W., which at night leads southward of all the shoals.

The Horse of Willingdon, consisting of stone and rock, lies N.W. by W. 2 miles from the Royal Sovereign buoy, and from its shoalest spot, with 3 fathoms water, Hankham mill is just seen westward of the third tower from Langley fort, or the seventh tower from Eastbourne, N. $\frac{1}{2}$ W., and Beach head signal-house bears W. by N. $\frac{1}{4}$ N. $4\frac{3}{4}$ miles. There are strong rippings over this shoal.

The Elphick Tree is a small shoal patch of 30 feet water lying about three-quarters of a mile north-west of the shoalest part of the Horse of Willingdon; and between it and the shore, about $1\frac{1}{2}$ miles from Langley fort, is a small rocky spot of 4 fathoms, from which the fort is in one with Hankham mill and the three mills at Eastbourne is just open southward of the coast-guard staff, near the Redoubt.

The Long Shoal is a narrow bank of 18 to 22 feet water, about a mile in length in a W. by S. direction, lying a little to the northward of the Royal Sovereign shoal. A smaller patch, called Kinsmans Nab, of only 22 feet water, nearly joins its western edge: the marks for which are, Willingdon chalk-pit on with the first tower, and Hankham mill just open east of the eighth tower eastward of Eastbourne.

DIRECTIONS.—Rounding Beachy head from the westward, Seaford cliff kept just in sight to the southward of the pitch of Beachy head will lead at least 2 miles south of the Southern head; and when the two high white mills at Battle come in line with the town of Bexhill, about N.N.E., the vessel will be eastward of the Royal Sovereign shoals, and may haul up about E. by N. for Dungeness. Fairlight mill on with Hastings east cliff will lead a quarter of a mile eastward of the Southern head, and to the eastward of all the shoals.

From Hastings a vessel may pass north of the Royal Sovereign shoals by keeping Fairlight mill on with the east end of St. Leonards, near St. Leonards gate; but if bound south of the shoals from Dungeness, do not steer westward of W. $\frac{3}{4}$ S. before Beachy head lighthouse or Seaford cliffs opens out.

Small vessels should not approach too near Beachy head when rounding it, as the Head ledge, a long narrow ridge of sandstone, extends from its south-east pitch in a S. by W. direction half a mile from the signal house. When rounding from the westward, they should keep the lighthouse well

open south of the head ; and in rounding from the eastward, the new church at Eastbourne open east of Wish Tower cliff ; but in bad weather an offing should be kept of 2 miles outside the strong rippings and heavy broken sea, which extends about $1\frac{1}{2}$ miles off shore, and which is caused by a narrow ridge of rocks running out S.S.W. from the signal-house. There are less than 10 fathoms water on them, 13 fathoms to the westward, and a hole of 17 fathoms to the eastward.

At Night, vessels coming from the eastward will open Beachy head light to the southward of the pitch of the head, on a N.W. $\frac{3}{4}$ W. bearing ; and whether bound up or down Channel, when eastward of the head, and within 9 miles of it, by keeping the light open they will pass south of the Royal Sovereign shoals.

EASTBOURNE BAY affords good shelter with the wind to the northward of West or N.E. by E., in $3\frac{1}{2}$ fathoms, sand, abreast the Grand redoubt, with Willingdon church spire open west of the redoubt, and the towers to the northward of Langley point just opening east.

Life Boat.—A life boat is stationed at Eastbourne, which is also a coast-guard station.

Hollywell Bank.—A bank, composed of large loose rocks, and which dries a foot at low water, lies a quarter of a mile off Wish tower which stands on the sandstone cliff to the south-east of Eastbourne. The long mark for the bank is the square tower of Westham church, in line with the eastern edge of the Grand redoubt ; but a vessel to tack clear of it must have the church half way between the redoubt and the first tower to the eastward. A ridge of sand runs from this bank in a S.W. $\frac{1}{2}$ W. direction nearly parallel with the coast, and terminates to the south-east in Hollywell bank, half a mile eastward of Beachy head ledge. The bank carries a depth of 8 to 12 feet, with 14 to 17 feet in a narrow gut named Whitbread hole between it and the shore.

Westham church open east of the Grand redoubt, leads eastward of the Hollywell ; and the little spire of Hertsmonceaux church in one with the western part of Westham church, or Hankham mill in one with the battery houses on Langley point, leads between it and the Royal Sovereign shoals.

Hollywell Ledge is a ridge of high sandstone rocks commencing abreast the chalk cliff to the south-west of Wish tower, and terminating a little below the lime quarries. A large sandy flat extends along shore between it and the cliffs, on which vessels ground to load with lime, and are protected by the ledge from the break of the sea.

PEVENSEY BAY is between Langley point and Walls-end houses, and with the wind to the northward of W.S.W. affords good anchorage for small vessels, over sand and mud. They should bring up abreast the third tower

northward of Langley point, with Beachy head signal-house just open of Langley point, or Pevensey church or castle bearing N. $\frac{1}{2}$ E.

Pevensey Shoal, with $2\frac{3}{4}$ fathoms, is an isolated patch lying about midway between the Royal Sovereign shoal and the shore in a N.N.E. $\frac{1}{2}$ E. direction, and has 5 and 6 fathoms close to and around it. From the shoal Beachy head bears W. $\frac{1}{2}$ S., and the coast-guard house at the east end of Pevensey bay N. by W. Between Pevensey and Royal Sovereign shoals are some patches with $4\frac{1}{2}$ and $4\frac{3}{4}$ fathoms water.

BEXHILL stands on the first rising ground westward of St. Leonards, and is conspicuous from seaward, having on the summit amongst the trees a church with a low tower, whilst to the westward of it is a remarkable high white house.

Off Galley hill, which is the nearest cliff eastward of Bexhill, and the second westward of St. Leonards, are several rocks 2 or 3 feet above water; and a little westward of these, at a third of a mile off shore, between the bearings of S. by E. and S.S.W. from Bexhill church, are several rocks awash, called Bexhill reef, having 6 feet water between them and the shore; Fairlight high mill over the west end of St. Leonards leads south of them in 7 feet at low water.

To the westward of Galley hill, off Nos. 4, 5, and 6 towers, and a third of a mile from the shore, a reef named the Oyster dries in several spots at low tides; this, as well as Bexhill reef, will be avoided by not going north of the line of Willingdon chalk-pit on with the first tower eastward of Walls-end houses.

No good anchorage will be found between Galley hill and the sluice houses to the westward, as the ground is foul, and several rocky patches, called the Coxheath shoals, with 8 to 12 feet water over them, lie half a mile outside the Oyster reef, and nearly a mile to the southward of the fifth tower (No. 50) west of Galley hill. Willingdon chalk-pit on with the second tower to the westward of Walls-end houses, or Fairlight mill over the west end of St. Leonards, leads south of all the foul ground between Bexhill and the sluice houses.

HASTINGS is between Bexhill and Fairlight, immediately to the westward of the sandstone cliffs, the greater part of the town being built in the valley between East hill, or Rock-a-nor point, and West hill, on which stands the ruins of an old castle and three conspicuous windmills. St. Leonards is the continuation of Hastings in a westerly direction, and consists of well-built terraces.

The principal maritime importance of Hastings is its fishery, which employs a considerable number of boats. The anchorage off the town is only used by vessels having to discharge a cargo on the beach, or to wait

a tide, bearing well open for safety; for with the wind in the southward of West, a heavy sea runs in in the night. They usually bring up with Fairlight high water-gate; some will open at the cliff. Several rocky ledges extend some distance from the shore, and are dangerous to vessels when covered; but the shore of the high land some distance to the northward of Pevensey and Rye, keeps on with or a little south of Galleys hill, and the shore will lead to the northward.

LIGHTS.—The shore at Hastings being flat and rocky, it makes a bad landing place for vessels; the best, however, is abreast the fish market, near the eastern part of the town, and for the guidance and safety of the fishermen, in sailing on shore, two fixed lights have been established on a N.N.E. and S.S.W. bearing, 300 yards apart. The upper light, white, is shown at 60 feet above high water from the side of West hill over the houses in the town; and the lower light, red, at 30 feet from an octagonal building near the fish market on the beach.

Boulder Bank.—The shoals lying abreast the mortella towers between Fairlight and Rye are named Boulder bank and Tower knoll. The latter lies a mile off shore, and from its shoalest part of 6 feet water the third tower—No. 36, to the eastward of Hook point—is in line with Dogs hill mill, which is black, and stands westward of the thick wood at Winchelsea. The Boulder bank is a ridge of sand with several banks of coarse gravel and stones on it, lying about $1\frac{1}{4}$ miles off the coast abreast the eastern side of Fairlight hills. Bexhill just open of St. Leonards, or St. Leonards well open of the east cliff at Hastings, leads to the southward; and Playden church steeple in one with the turret of Rye church, leads well to the eastward.

In coming from the eastward, when Fairlight church bears North, a ship of 18 feet draught may stand over the long 4-fathom sand ridge which is a continuation of the Boulder bank to the south-eastward, and tack in-shore abreast Fairlight cliffs in any convenient depth of water.

RYE HARBOUR is formed in the channel of the river Rother, at the point where it enters the sea after receiving the waters of the Tillingham and Brode, two small rivers which unite with it near the town of Rye. The harbour is chiefly used by coasters and fishing vessels, and being difficult of access, the services of a pilot are indispensable. A steam tug is always in readiness, and the signal for her is a wift at the peak, or burgee at the main.

The number of vessels belonging to Rye in 1868 was 55, total tonnage 8,821 tons. During the same period 27 vessels, of 3,543 tonnage, entered inwards from foreign, and 331, of 29,502 tonnage, coastwise; and 42 vessels, of 2,838 tonnage, cleared outwards coastwise, and for foreign 6 vessels

of 370 tons. In addition to the above, about 100 vessels entered the harbour windbound, and did not discharge their cargoes.

The principal imports are timber, oilcake, coal, and soda. The exports, oak timber, bark, and flints. There is a patent slip, on which vessels of 90 feet keel and 300 tons burthen have been hove up for repairs at ordinary springs. The population of the town in 1861 amounted to 4,079.

LIGHTS.—Two *fixed* white lights, 180 yards apart, are exhibited near Camber at the north side of the entrance of Rye harbour, during the time there are 10 feet water and upwards on the bar. When in one bearing N. $\frac{1}{2}$ W. they lead over the sand in front of the harbour, in the same water that the harbour signals indicate. They are elevated 47 and 24 feet respectively above high water, and are visible about 5 miles.

A *red* light is shown at 32 feet above high water on the east side of the entrance, S.E. 216 feet from the old pier head, during neap tides, when there are 8 feet water at the gauge board; and continues burning until there are 10 feet, when it is extinguished and the two usual white lights exhibited. When there are not 10 feet flow of tide, this light will be shown till high water. When the depth is 12 feet at the gauge board the red light will be again exhibited, in addition to the two white lights, and will continue until high water, when it will be extinguished.

There is also a *red* light 19 feet above high water on the Dolphin, to show the end of the eastern pier. This light is shown when flood at the pier, and burns until about two hours after high water.

There is also a *green* light at the extremity of the new groin, at the western entrance of the harbour, which will be shown from half flood to about half ebb. The white tide lights when in one N. $\frac{1}{2}$ W., will lead into the entrance between the *green* light on the groin, and the *red* light on the east pier head, distant from each other 87 yards N.E. and S.W.

Life Boats.—A life boat is stationed at Hastings, Winchelsea, and Rye.

TIDES and TIDAL SIGNALS.—It is high water, full and change, in Rye bay at 11h. 20m.; springs rise 22 feet, and neaps 17 $\frac{1}{4}$ feet. The springs rise at the point 16 feet, at the town 12 $\frac{1}{2}$ feet, and at the float sluice 11 $\frac{1}{2}$ feet. The depth in the harbour at high water springs is 15 and 16 feet, at neaps 10 and 11 feet. The flood runs in round the beach with a velocity of 6 knots, but its rate lessens inside. It would not be prudent to leave the harbour during the strength of the tide, but wait till it slackens, about half an hour before high water.

The Telegraph at the entrance of the harbour, near the flagstaff, shows the flowing of the tide. The frame and shutters are black, and when not in use hang vertical, and appear all black; when in use the shutters are canted horizontally, so as to show a circle of light through the frame, and are worked as follows:—When there are 8 feet water one shutter is

cannot: when 1 foot both shutters are raised: when 10 feet the flag is raised: when 10 feet one shutter is raised: when 12 feet both shutters are raised: so that the shutters without the flag denote under 10 feet, and with the flag above 10 feet.

When there are more than 12 feet water red flags are hoisted on the Telegraph flagstaff as follows:—one flag hoisted half-mast denotes 13 feet; and hoisted up 14 feet. Two flags half-mast denotes 15 feet, and hoisted up 16 feet.

A black ball is hoisted on the ball-pole, at the harbour flagstaff, in bad weather or low tides, to signify that the pinks cannot get off, and that the harbour cannot be approached with safety by strangers. A blue buoy on the ball-pole signifies high water at the pier head.

DIRECTIONS.—Approaching the entrance of Rye harbour look out for the black buoy, which are placed on the low water western edge of the channel, and having left them on the port hand, and the red and white buoy on the starboard hand, steer to pass to the south-west of the red and white buoy placed at the end of a low stonework extending 600 feet from the Dolphin, and over which there is the same water that the tidal signals indicate. Thence the two tide lights in one will lead straight up to the eastward of the pilots' houses on the point, leaving all the broom beacons on the low stonework to starboard, and the triangular beacon and the beach to port. When as far up as the pilots' houses either anchor, or make fast alongside one of the seven berthing places on the eastern shore.

DUNGENESS LIGHTS.—To the eastward of Rye, and between it and Hythe, is an extensive tract of land known as Romney Marsh, and on its extreme south-eastern point stands Dungeness lighthouse, 92 feet high, and coloured red and white in alternate horizontal bands. From it, at an elevation of 107 feet above high water, is exhibited a *fixed* white electric light of the first order, visible in clear weather from a distance of 15 miles.*

The *red* light marking the anchorage inshore westward, is shown from a window below the lantern, with the lantern bearing East; and the *red* light marking the anchorage eastward is shown from the lantern with the lighthouse bearing S.W. by W. $\frac{1}{2}$ W.

The shingle beach at the Ness is low and flat, the highest part being only 4 feet above the level of high water springs; off the pitch of the Ness near the lighthouse it is steep-to, there being 4 fathoms at 100 yards, and 15 fathoms at 330 yards from the beach.†

* This lighthouse was erected in 1792, at 100 yards distance from the sea at low water by Thomas William Coke, Esq., of Holkham House, in the county of Norfolk, instead of the old lighthouse, which originally stood 546 yards to the northward, and which, by means of the land increasing by the violence of the sea, became useless to navigation.

† See Chart:—England, South Coast, Sheet 7, Dungeness to the Thames, No. 1,895; scale, m = half an inch.

Fog Horn.—During foggy weather a powerful horn will be sounded from Dungeness lighthouse. The mouth of the horn will traverse an arc of 210° , viz., from N.E. by E. $\frac{1}{2}$ E. (round South) to W. $\frac{1}{2}$ N., and *vice versâ*, so as to point in every direction between those bearings once in each minute; the duration of the sound being *five seconds*, with an interval of *twenty* seconds between each blast.

PILOTS.—Three pilot cutters cruise between Dungeness and the South Foreland, to supply vessels coming from the westward with pilots; one will be found off Dungeness, the second in the fairway between Dungeness and Dymchurch, bearing N.N.W., and the third off Folkestone, well out in the fairway.

A Life Boat is stationed at Dungeness.

ANCHORAGE.—The roads on either side of Dungeness afford excellent and extensive anchorage, according to the state of the wind, with good holding ground, consisting of fine sand, over clay and mud.

The west road comprises the space between the first building westward of the lighthouse, and the black coast-guard buildings at Jewrys gap. It affords good shelter from winds between north and E. by S., and is much frequented by vessels bound to the northward. The best anchorage is in about 6 fathoms, with Romney church tower in one with Lydd church N.E. $\frac{3}{4}$ E., and Dungeness lighthouse E. $\frac{1}{4}$ S. Smaller vessels may run farther in towards the beach, guarding always against a sudden shift of wind. The western tide runs easy, and affords a good slack for running or working in.

The east road of Dungeness affords good shelter from westerly winds to vessels of all classes in from 4 to 12 fathoms, with the wind between N. by E. and S.W. A good position is in 7 fathoms water, with Lydd church just open north of No. 2 battery, N.W. by W. $\frac{3}{4}$ W., and the lighthouse S.W. by W. $\frac{1}{4}$ W.

At night the rays of red light, already described, define the outer limits of the anchorage in West and East bays.

Stephenson Shoal.—About $3\frac{1}{4}$ miles W. $\frac{1}{2}$ S. from Dungeness lighthouse, is the eastern end of a narrow ridge of sand, called Stephenson shoal, which thence extends nearly three-quarters of a mile in the same direction, and carries a depth of 19 to 23 feet, with 4 to 5 fathoms water around it. The east mill at Lydd in line with No. 4 coast-guard houses bearing N.N.E. $\frac{1}{2}$ E., leads eastward of the eastern end in 5 fathoms; Rye church on with the new church spire near Rye harbour N.N.W. $\frac{3}{4}$ W., clears the western end in 27 feet; Fairlight church and mill in one W.N.W., leads half a mile to the south-west of the shoal; and the South Foreland and Dungeness lights in one, E. by N. $\frac{3}{4}$ N. three-quarters of a mile to the southward.

Newcome, Swallow, and Roar Banks lie in the East road of Dungeness.

The Newcome is an accumulation of sand contiguous to the beach, about $1\frac{1}{4}$ miles to the northward of Dungeness, and must be carefully avoided when standing inshore or running for the road. A chequered black and white buoy, marked Newcome, is placed in 16 feet water, $1\frac{1}{2}$ miles N.E. by E. from Dungeness lighthouse, and E. by S. three-quarters of a mile from the first battery north of the lighthouse; there are 5 and 6 fathoms close outside the buoy.

Swallow bank, lying directly in the anchorage of the road, has a shoal spot of 18 feet on it, from which Dungeness lighthouse bears S.W. $\frac{1}{4}$ W., $2\frac{3}{4}$ miles, and Romney church N.W. by N. Lydd church open north of the second battery northward of the lighthouse N.W. by W. $\frac{3}{4}$ W., leads to the southward in 31 feet water; and the lighthouse W.S.W., or Beachborough summer-house in line with Hythe church N.E. by N., leads to the eastward.

The Roar is a narrow ridge of sand running nearly parallel with the coast at $1\frac{1}{4}$ miles from high-water mark. Its south-west end commences abreast the large opening called Romney bay, and thence it extends $2\frac{1}{2}$ miles in a N.E. by N. direction, and terminates in 14 feet water about S.S.E. $1\frac{1}{4}$ miles from Dymchurch. It carries a depth of 9 to 12 feet, and there are 2 and 3 fathoms water between it and the shore. A vessel should not approach it within 6 fathoms water.

Hythe Flat is the shallow extending from the shore between Dymchurch and Shorncliff battery. The least water on it is 22 feet; and its outer edge in 5 fathoms abreast the mortella tower, is about 2 miles off shore. A vessel of large draught standing towards this flat should go about directly the South Foreland high lighthouse or light is shut in by Shakspeare cliff.

At $2\frac{1}{2}$ miles to the south-west of Hythe is a circular redoubt, called Brockman's barn, at which commences the well-known Dymchurch wall, a sea embankment for the rich pasturage of Romney marsh.

SANDGATE ROAD, off Sandgate, is much frequented by light vessels bound to the northward, as the western stream is easy, and affords good shelter with the wind to the northward of E. by N. They anchor abreast the castle, with the pier clock at Folkestone just clear of Mill point, in 6 to 8 fathoms water, over mud and clay, good holding ground.

FOLKESTONE HARBOUR.—Mill point is three-quarters of a mile eastward of Sandgate, and between it and Copt point, the first cliff eastward of Folkestone, is the tidal harbour of Folkestone. All this part of the coast is bordered by a series of rocky ledges, extending from $1\frac{1}{2}$ to 3 cables from the shore. Those off Mill point and abreast Folkestone church cover at 4 feet flood, when they are dangerous to coasters, as it is not easy

to estimate the correct distance from the shore ; Hythe church open of the stone wall fronting Shorncliff battery, leads to the S.W.

Copt ledge extends off Copt point, and is composed of large sandstone rocks, which uncover 6 feet above low-water springs. The Mole-head rocks are a continuation to the westward of Copt ledge, and uncover 2 feet. The two western mortella towers near Hythe just open of the low part of Mill point, leads south of the Copt ledge and Mole-head rocks.*

Folkestone harbour is the property of the South-eastern Railway Company, and has been cleared out for the use of their steamers, which ply to Boulogne ; but the entrance is awash at low water springs. The harbour encloses an area of 14 acres, and is divided into two parts, named outer and inner harbour, by the railway which crosses it, over a swinging bridge. It has quay room to berth about twelve brigs, besides the company's ten steamers, and there are good beaching places for boats, but it is in no way used for refuge. On its south side are the railway station, custom house, and baggage warehouse. A lighthouse 26 feet high, and a flagstaff for hoisting the tidal signals, stands on the south pier head of the outer harbour.

A new pier has been run out 120 yards in a south-east direction from the extremity of the horn which was projected S.S.W. from the south pier to prevent the accumulation of a shingle bar, and to shelter the entrance from westerly gales ; there are 12 feet at the pier end at low water springs. Mooring anchors are laid down at convenient distances, with chains led towards the pier, with which they are connected by smaller chains ; so as to enable vessels to heave in the larger chain if necessary.

There is a patent slip in the harbour, but it is only used for the company's vessels, the largest of which is 560 tons, and 8 feet draught ; the slip is 450 feet long, 19 feet gauge, and its incline one in 24. There is also an excellent gridiron, 220 feet long, on the north side of the coal wharf, for the use of the Railway company's largest steamer, or other vessels not exceeding 9 feet draught. Thirty vessels belong to the port, exclusive of 35 large fishing luggers, and their total registered tonnage is 4,600 tons. The population of the town in 1868 has been estimated at 11,000.

TIDES and TIDAL SIGNALS.—At Folkestone it is high water, full and change, at 11h. 7m. ; springs rise 20 feet, and neaps $16\frac{1}{2}$ feet. The average depth is $20\frac{1}{2}$ feet between the pier heads at high water ordinary springs, and 14 feet at neaps. During the equinoctial months and preceding heavy gales, there are sometimes 23 feet between pier heads at springs, and 16 feet at neaps ; and during the continuance of settled fine weather not more than 10 feet at neaps. There are 17 feet in the outer harbour at high water springs, and 13 feet at neaps. The differ-

* See Admiralty plan of Folkestone Harbour, No. 1,991; scale, $m=16$ inches.

ence of level between the entrance of the outer harbour and the west end of the inner harbour is 5 feet, and vessels of 13 or 14 feet draught may safely enter the latter at high water springs.

A red flag hoisted half-mast on the flagstaff on the south pier head indicates from 10 to 14 feet water between pier heads; and is hoisted close up when there are from 14 to 16 feet. When the depth is above 16 feet, a black ball is shown under the red flag.

When the flag is hauled down to the base of the flagstaff, it indicates that caution is necessary; and when the red flag is not shown, there are less than 10 feet between pier heads, or some obstruction in fairway; or the harbour is inaccessible on account of the weather.

LIGHTS.—A *fixed red* light, elevated 37 feet above high water, and visible in clear weather at 6 miles, is shown from the lighthouse on the south pier head at Folkestone while there are 10 feet water between the pier heads.

A *white* light is shown under the above red light while the depth is above 16 feet.

When the red light is blinked at intervals, it indicates that caution is necessary.

When the lights are not exhibited, there are less than 10 feet, or some obstruction in the fairway; or the harbour is inaccessible on account of the weather.

An iron skeleton lighthouse stands on the extremity of the new pier, S. $\frac{1}{4}$ W., westerly, 212 yards from the lighthouse on south pier head. It exhibits at 31 feet above high water a *fixed* light all night, visible in clear weather at 6 miles. The light shows *green* seaward over an arc of 155° , or from E. by N. $\frac{3}{4}$ N. to W. $\frac{1}{2}$ N., which lines of bearing pass about 65 yards outside the Oak End rocks on the west side of the pier, and the same distance outside the Mole Head rocks on the east side; and it shows *white* to the northward of these limits or towards the land. The light changing from green to white indicates that the vessel is in the stream of danger.

DIRECTIONS.—All vessels are strictly cautioned against entering this harbour when the red flag is not shown by day, or the red light at night. When entering it must be remembered that with the flood there is generally a strong set towards the south pier head, and an eddy along the shore from Copt point towards the entrance. The Royal George hotel, which has three large stacks of chimneys, in line with the lighthouse on south pier head, will lead westward of the Mole Head rocks; but if there is any swell on, it will be safer to keep the hotel open south of the lighthouse, until the vessel is about two ships' lengths from the pier head.

The anchorage off Folkestone is only used by vessels waiting tide to go into harbour, for it is much exposed and limited, there not being

room for more than four or five vessels to ride at the same time. The best holding ground is in 7 to 10 fathoms, clay and sand, with the pier lighthouse in line with the eastern houses near the north side of the harbour, bearing North, and the church in one with a terrace on the beach west of the clock-house. At night keep the red light a little open west of the green light on the new pier.

EASTWARE BAY is between Copt point and the railway tunnel through Abbots cliff; and though it has good holding ground, and well sheltered on the west side by Copt point and ledge, yet it can only be recommended as a temporary anchorage for vessels waiting tide. The best berth is in about 5 fathoms, abreast the coast-guard cottages under the cliffs, with Folkestone church a little open of Copt point. The shore of the bay is flat and covered with large stones, which makes landing bad at low water. Between this bay and Shakspeare cliff there is no good anchorage off the coast, as the water is deep and the ground foul.

Shakspeare cliff is the first chalk cliff westward of Dover, and when seen from the eastward, presents a conical appearance; but from the southward there is nothing remarkable in its features; on its summit is a flagstaff, on which is hoisted storm signals to passing vessels.

DOVER BAY.—The town of Dover, in the western part of the bay, and about $5\frac{1}{2}$ miles eastward of Folkestone, is easily recognized by its historic castle, which stands on an eminence on the east side of the town, and is surrounded by works ancient and modern occupying an area of about 30 acres.

The port has an outer or tidal harbour 12 acres in area, and within it an inner harbour of 6 acres, and a Pent of $11\frac{1}{2}$ acres. There is a patent slip in the Pent, and a floating dock opens into the western part of the outer harbour. The entrance is between two piers, but it is narrow and open to the south-east. Formerly, with gales from the westward, the sea broke across it to the distance of 300 feet off, and the pier heads being only 140 feet apart vessels required careful steerage in entering; the Admiralty pier, originally commenced for a great harbour of refuge, has much improved the entrance, though it is still bad with on-shore gales.*

The best time to enter the outer harbour is about $1\frac{1}{2}$ hours before, or 2 hours after high water. There are 19 feet at the entrance at high water springs, and 12 to 15 feet at neaps. The outer harbour has 17 feet in it at high water springs, and 10 to 13 feet at neaps, and dries an hour before low water; but the depths are quite uncertain, as much depends upon the winds, which at times makes a great difference in the flow.

* See Admiralty plan of Dover Bay, No. 1,698; scale, $m = 10\frac{1}{2}$ inches.
23662.

In the inner harbour and in the Penn there is only a foot less water, the sill of the gateway being a foot above the level of the outer harbour. The gateway leading from the outer harbour to the Penn is 56 feet wide, and the gateway, from the inner harbour to the Penn, is 47 feet wide; the swinging bridge gateway, connecting the outer with the inner harbour, is 37 feet wide. The piers are 450 feet long, and 115 feet length of crane, is worked by steam, and capable of taking a vessel of 500 tons burden.

The Admiralty pier runs out in a S.S.E. direction from Cheeseman head, about 167 yards westward of the entrance to the harbour, and is at present 322 yards in extent. Vessels of large draught can go along both sides of the pier at any time of tide; and fresh water can be obtained in abundance. The tidal trains go regularly on to the pier to meet the continental mail steamers.

A buoy is placed off its extreme end where there are 6 to 7 fathoms water, but vessels should give it a wide berth to avoid the strong eddy. At half flood the ebb makes to the westward out of Dover bay, and meeting the offing stream running to the eastward at the extreme end of the pier, causes a heavy sea in westerly gales; but thence to the entrance of the harbour the water in the space sheltered by the pier is smooth.

During the prevalence of north-easterly winds, Dover bay is much frequented by coasters bound to the northward, the usual anchorage being abreast the Esplanade, with the South Foreland lighthouses shut in by the hills; but small steamers anchor closer inshore. With easterly winds the mail packets either anchor off or haul alongside the western side of the pier. The great extension of the Admiralty pier affords shelter from winds to the westward of W.S.W., but though with these winds a heavy swell is experienced, it is not dangerous, as the strong eddy which is created by the breakwater sets to the westward, and thus becomes a weather tide.

The anchorage however on either side of the pier should only be considered temporary, especially for large vessels, or those without steam power, for the shelter is not great, and the holding ground not good; therefore immediately the pier becomes a lee shore, vessels should quit the anchorage.

In 1868, 1,953 vessels entered the port inwards, and 2,002 cleared outward. Besides these, 1,329 steam vessels arrived, carrying mails, passengers, baggage, and parcels only, and 1,174 sailed. There were belonging to the port 57 vessels, representing 3,813 tons. In 1861 the population (exclusive of military) amounted to 22,843. On the north end of the north pier there is a private flagstaff for the purpose of acknowledging vessels' numbers as they pass the port, either outward or homeward bound, and they are immediately reported by telegram to Lloyds.

TIDES and TIDAL SIGNALS.—It is high water at Dover, full and change, at 11h. 12m. ; equinoctial tides rise $20\frac{1}{2}$ feet, ordinary springs $18\frac{3}{4}$ feet, and neaps 15 feet.

In the day a red flag is hoisted with a black ball under it while from 7 to 10 feet water at the entrance ; the red flag alone when from 10 to 13 feet ; and the ball over it when 13 feet and upwards.

No signals are made between 7 feet at ebb and 7 feet at flood ; and whenever, at other times, the harbour is inaccessible to vessels, the flag is hauled down, or the light or lights on the south pier extinguished.

LIGHTS.—Two *red* tidal lights, of unequal heights, are exhibited from a staff on Dover south pier head, and a small low *red* light on the north pier head. This latter red light, and a similar *red* light on the low outer corner of the south pier, are shown when there are from 7 to 10 feet water at the entrance ; the two red lights on the staff on the south pier, and the low red light on the north pier when above 10 feet, and till the water has fallen again to that level ; and the single low red light on each pier when there are from 10 to 7 feet. These lights only point out the position of the piers, and do not indicate the channel.

A *green* light is shown all night from the cross wall near the clock-house ; and when seen between the piers, leads into the fairway to and up the harbour. A *blue* light is exhibited at the extreme end of the Admiralty pier, and a bell is sounded in foggy weather.

A *Life Boat* is stationed at Dover.

SOUTH FORELAND LIGHTHOUSES.—The South Foreland, bearing E. by N. $\frac{3}{4}$ N. $20\frac{1}{2}$ miles from Dungeness, and N. $\frac{1}{4}$ W. $17\frac{3}{4}$ miles from Cape Gris-Nez, is a bold headland faced with irregular chalk cliffs having layers of flint in horizontal lines. On its summit are two white light-houses, 449 yards apart, which exhibit two *fixed* white lights of the first order, elevated respectively 372 and 275 feet above high water, and visible in clear weather from distances of 26 and 23 miles ; when in one, W. by N., they lead a mile south of the Goodwin sands. The western lighthouse is 69 feet high and square ; the eastern lighthouse, 49 feet high and octagonal, stands near the edge of the cliff.

CAUTION.—A submarine cable extends from the South Foreland to Belgium. It takes an E. by S. direction from the Foreland, with the light-houses in line W. by N., until without the stream of the Goodwin sand, passing about a mile to the southward of the South Sand Head light-vessel, after which it runs E.S.E. across to the Flemish banks. Vessels are cautioned not to anchor with this mark or bearing on, lest they damage the electric cable, or lose their anchors.

A submarine cable also extends between the South Foreland and France, and in order to prevent mischief occurring to it, vessels should

we are so close to the Channel, it is not a mile of the English shore with the light. I should not imagine any danger between North and N.W., as it is not a mile from the light. I.V. by N. which bearing it will appear to be with a light from the light. Neither should we be in danger of the Dover coast, with the two dangerous shoals of the Channel which are in the light from the light. Neither should we be in danger of the Dover coast, with the two dangerous shoals of the Channel which are in the light from the light.

DOVER STRAIT.—The channel navigation for large ships is much narrowed in the vicinity of Dungeness by banks composed of coarse sand and broken shells, the principal and most dangerous of which are, the Varne, the Ridge, the La Coudre, the Brouette, and the Vergoyer. There are only 5 feet of water in the Turin; 10 more than 5 feet on the Ridge; 12 fathoms in the Brouette; and 13 feet in the Vergoyer. The Varne and Ridge lie exactly in the fairway of Dover strait, at nearly equal distances from the English and French coasts, and nearly parallel with each other; some of these banks are continuous, but consist of shoal patches, having deep water between them.

VARNE SHOAL, the northernmost of these dangers, lying in a N.E. by E. and S.W. by W. direction, is about $4\frac{1}{2}$ miles in length between the depths of 7 fathoms at each end, and its breadth varies from half to three-quarters of a mile. It is steeply, and from the shallowest spot of 9 feet, which lies about a mile from its north-east end, Dover castle bears N. by E. $\frac{1}{4}$ E. $4\frac{1}{2}$ miles. From the north-east end of the shoal the South Foreland bears N.N.W. $4\frac{1}{2}$ miles, and Dover castle N. $\frac{3}{4}$ E. 8 miles; and from the south-west end, Dover castle bears N.N.E. $\frac{1}{4}$ E. $11\frac{1}{2}$ miles, and Dungeness lighthouse W. by N. $\frac{1}{2}$ N. $12\frac{1}{2}$ miles.

There are strong rippings over the Varne both at springs and neaps, and during tempestuous weather a heavy sea, which would endanger any vessel attempting to cross it. Folkestone church seen between two conspicuous chalk pits on the face of the distant hills, N.W. by N., clears the north-east end of the shoal in 7 fathoms, and leads a mile to the north-eastward of the shoal patch of 9 feet, and about two cables south-west of the N.W. Varne buoy; and the eastern terrace at Sandgate between the above chalk pits N. $\frac{1}{4}$ W., or the square tower of Lymington church on with Lymington wharf, clears the south-west end.

buoy. A large red spiral buoy, surmounted by staff and ball, and marked N.E. Varne is moored off the north-east end of this shoal in 13 fathoms at low water; with Dungeness lighthouse bearing West, northerly, 10 miles; Folkestone church N.W. $\frac{3}{4}$ N. 8 miles; South Foreland lighthouse N.N.E. 8 miles; Cape Gris-Nez lighthouse S.S.E. $\frac{1}{4}$ E. $11\frac{1}{2}$ miles; and the Varne light vessel N.W. by W. $\frac{1}{4}$ W. 5 miles.

VARNE LIGHT-VESSEL lies in 15 fathoms, about a mile W. by N. $\frac{1}{2}$ N. from the depth of 7 fathoms on the south-west end of the shoal, and exhibits at 38 feet above the sea a *revolving red* light, which attains its greatest brilliancy every *twenty seconds*, and in clear weather should be visible from a distance of 10 miles. The vessel carries a ball at mast-head by day, and from her Dungeness lighthouse bears W. by N. $\frac{1}{4}$ N. $11\frac{3}{4}$ miles; Folkestone church N. $\frac{1}{4}$ W., $9\frac{2}{10}$ miles; South Foreland high lighthouse N.E. $\frac{3}{4}$ N. $12\frac{1}{2}$ miles; N.E. Varne buoy, N.E. by E. $\frac{1}{4}$ E. $5\frac{4}{10}$ miles; and Cape Gris-Nez lighthouse S.E. $\frac{1}{2}$ E. $12\frac{3}{10}$ miles. A watch buoy is moored in 9 fathoms S.E. by E., eight-tenths of a mile from the light-vessel.

RIDGE SHOAL.—The north-east end of this shoal—called by the French *Le Colbart*—in 7 fathoms lies about 2 miles south of the body of the Varne, there being 16 to 20 fathoms in the channel between them; it then takes a S.W. $\frac{1}{4}$ W. direction for about $8\frac{1}{4}$ miles to the same depth, and is about three-quarters of a mile broad. Like the former shoal, it is steep-to, and composed of sand and broken shells, the shoal patches lying in ridges across the stream, which occasion strong eddies even at neap tides. There is much sea on it during a weather tide, and in bad weather there are breakers on the shoalest parts; no vessel should therefore attempt to cross it under any circumstances.

The shoalest water, 6 feet, on the Ridge lies about $2\frac{1}{2}$ miles from its south-west end, with the Varne light-vessel bearing N. $\frac{3}{8}$ E. nearly 5 miles; Cape Gris-Nez E. by S. $\frac{3}{4}$ S., $10\frac{1}{2}$ miles, with the summit of Mount Couple appearing a little south of it; and Dungeness lighthouse N.W. $\frac{3}{4}$ W., $13\frac{1}{4}$ miles. From the north-east extreme of the shoal, in 7 fathoms, Cape Gris-Nez bears S.E. $\frac{1}{2}$ S., $8\frac{3}{4}$ miles; the high trees at the back of Hythe are in line with the *Swisster* race at Sandgate, N.N.W. $\frac{1}{2}$ W.; and the Varne light-vessel W. by N. $\frac{3}{4}$ N., 4 miles. Mount Lambert—a conspicuous hill near Boulogne, with a fort on it—in one with the dome of the new cathedral at Boulogne, S.E. $\frac{1}{4}$ E., or Sangate Swiss terrace between the two chalk-pits, N. $\frac{1}{3}$ E., or the revolving light on Cape Gris-Nez bearing E. $\frac{1}{2}$ S., leads south of the south-western extreme in 9 fathoms.

BASSURELLE SHOAL, the body of which bears about W. $\frac{3}{4}$ N. 18 miles from Cape Alprech, and S. $\frac{1}{2}$ W. the same distance from Dungeness, is about 5 miles long E.N.E. and W.S.W., within the depth of 10 fathoms, and 2 miles broad; its shoalest parts forming a succession of elevated flats, the most considerable of which lie towards the north-east extremity of the bank, and serve as a basis for eight small hillocks of sand, upon the highest of which—when surveyed in 1835—a depth of only 22 feet was found at low water springs.

This bank is steep-to and dangerous to vessels of large draught at low tide ; at the springs there is a strong rippling over it, and in bad weather, during a weather tide, the sea breaks violently upon its highest parts. Mount Lambert semaphore just open south of the guard-house on Cape Alprech E. $\frac{1}{4}$ S., leads to the southward ; and Romney church open west of Dungeness lighthouse N. by E., leads to the westward.

BULLOCK BANK, lying S. $\frac{1}{4}$ W. 11 miles from Dungeness, is also indicated by strong rippings. It has 9 to 10 fathoms water on it, 17 fathoms at half a mile to the northward and southward, and a general depth of 11 to 14 fathoms between it and the south-west end of the Ridge, and Les Ridens. Romney church a little open east of Dungeness lighthouse, N. $\frac{1}{4}$ E., leads over the bank in 9 fathoms.

LES RIDENS form a bank composed of a number of patches of sandstone and gravel, lying S.S.E. $\frac{1}{2}$ E. nearly 16 miles from Dungeness, about $3\frac{1}{2}$ miles S. by W. from the south-west end of the Ridge, and W.N.W. 12 miles from the Napoléon column at Boulogne. The bank carries a depth of 6 to 10 fathoms, and is indicated by strong rippings over it when the tide runs with any strength, and by a heavy sea in bad weather. Cape Blanc-Nez well open of Cape Gris-Nez leads north of the bank; and shut in, leads south.

The **VERGOYER** is a sand-bank about 14 miles in length, N.E. by E. $\frac{1}{2}$ E. and S.W. by W. $\frac{1}{4}$ W., and a mile in breadth, lying within 10 and 14 miles of the French shore. The general depth on its southern part is 5 to 7 fathoms, the eastern edge being steep-to, and the western edge of a gradual slope ; but near its north extreme is a high flat spot about a mile in diameter, with only 12 feet on it at low water springs. From this spot, which lies about 10 miles off shore, the land in clear weather may be distinctly seen from the hills (at the foot of which stands the town of Etaples) to Cape Griz-Nez lighthouse, which bears from it about N.E. $\frac{3}{4}$ E. easterly $19\frac{1}{2}$ miles, and the lighthouse on Cape Alprech, E. $\frac{3}{4}$ N. $11\frac{1}{2}$ miles.*

Lydd church in sight to the west of Dungeness lighthouse, N.N.W., leads to the north-eastward of the Vergoyer ; and Mount Lambert midway between Outreau church and Alprech guard-house, E. $\frac{1}{4}$ S., to the northward. The rippings on this shoal during springs occasion a high sea on a weather tide ; and with a strong breeze, from whatever quarter it may blow, the sea breaks with violence upon the northern end, especially from half flood to half ebb.

* Cape Alprech lighthouse cannot be seen at this distance except when the weather is very clear ; in fine weather the light is visible 12 miles off.

DIRECTIONS.—It may be useful to remark that the excellent light exhibited on Cape Gris-Nez bears E. by S. 51 miles from Beachy head, S.E. by E. $\frac{1}{2}$ E. $23\frac{1}{4}$ miles from Dungeness, and S. $\frac{1}{4}$ E. 18 miles from the South Foreland. It is a *revolving* white light, attaining its greatest brilliancy every half minute, and should be seen in clear weather from a distance of 22 miles. The eclipses, which succeed each other every *half minute*, are not total in clear weather within the distance of 12 miles. This light cannot be mistaken for the fixed white light at Calais, which is varied every *four* minutes by a *white* flash; nor for the fixed white light at Cape Alprech, which is varied every *two* minutes by a *red* flash.

The course and distance from Dungeness to the South Foreland is E. by N. $\frac{3}{4}$ N. $20\frac{1}{2}$ miles, and the soundings vary from 17 to 13 fathoms. After rounding the Foreland at the distance of half a mile or a mile, the course is about N.E. by N. for the anchorage in the Downs.

A vessel turning to windward in thick weather, either up or down Channel, should not, when standing in-shore between Beachy head and Dungeness, go into less than 15 fathoms at low water. Between Dungeness and the South Foreland, 12 fathoms is a safe depth, as it will keep her outside the banks off Dungeness, and the rocks off Folkestone. Standing off shore, the Ridge should not be approached nearer than 17 fathoms water, nor the Varne than 16 fathoms.

The Varne light is a good guide for avoiding these shoals. When Dungeness light bears N.W. $\frac{1}{2}$ N. a vessel will be on the line of the south-west extreme of the ridge, and may stand towards that shoal till the Varne light bears N.N.E. $\frac{3}{4}$ E. Having arrived to the northward of the light-vessel she may in standing towards the Varne bring the Varne light as far as S.W. by W.; when the South Foreland lights bear N.N.E. she will be to the northward of the north-east end of the shoal. In standing in-shore between Hythe and Eastware bay, go about directly the South Foreland lights are shut in by Shakspeare cliff; off Folkestone, the helm should be put down when the high light disappears.

The DOWNS, in a general sense, implies the numerous banks lying immediately off the coast between the South and North Forelands; and though anchorage may be found anywhere in the channels which separate them, that which is commonly used, and known by the above name, is immediately off the town of Deal, between Walmer and Sandown castles, and outside the chequered black and white buoy on Deal bank.*

From the South Foreland the chalk cliffs continue nearly as far as Walmer castle, but thence the shore is low, and bordered by a beach of

* See Admiralty charts :—the Downs, with Views, No. 1,828, scale, $m=2$ inches; and North Sea, Sheet 1, No. 1,406, scale, $m=0.3$ of an inch.

shingle mixed with sand, to within $1\frac{3}{4}$ miles of Ramsgate ; it then becomes elevated, and about the North Foreland is faced by steep chalk cliffs of moderate height.

NORTH FORELAND LIGHTHOUSE.—The North Foreland is a promontory of nearly perpendicular chalk cliffs which, varying from 60 to 120 feet in height, form the sea front of the north-east side of the Isle of Thanet. It is the more conspicuous from an octagonal white light tower, 70 feet high, which stands on a rising ground about 300 yards within the edge of the cliff, and exhibits at 184 feet high above high water a *fixed* white light of the first order, visible in clear weather from a distance of 19 miles. In order to enable vessels at night to keep eastward of Margate sand, a *red* ray of light is seen from seaward between the bearings of S. by E. $\frac{1}{2}$ E. to S. $\frac{1}{2}$ W. or from the Tongue light-vessel to one cable east of Margate sand.

At half a mile northward of the lighthouse is Moro castle, a castellated building of flint, standing close to the cliff edge on the south point of Kingsgate bay ; at half a mile farther northward is Neptune tower, with a wide basement surrounding it.

GOODWIN SANDS.—These well-known sand-banks have been divested of much of their danger since the present excellent system of lighting and buoyage has been completed, and they can now be approached fearlessly in fine weather, as their limits are well marked by light-vessels and buoys. Along their eastern and northern edges large patches dry at low water, and remain uncovered for some time, offering fine tracts of level and firm ground. When covered, the sands are in motion, and are carried by the prevailing tides, which at times considerably alter the form of the shoal, though its general outline does not greatly change.

The sands are divided into two divisions, each tapering to the southward. The northern division, called the North Goodwin, is of an irregular semi-circular shape, the northern or outer edge forming the curve, and the southern the base. That portion of the southern division which lies to the eastward is named the South Goodwin and South Calliper, and that to the westward the Bunt and Fork. The northern part of each division is dry in many places from 7 to 4 feet above low water. Between the South Goodwin and the Fork is the deep inlet called Trinity bay from which there is an outlet to the north-east, through the Swatchway, which undergoes many changes, but is much frequented by the boatmen of the coast.

REFUGE BEACON.—On the eastern side of the Goodwin sands, between the east and S.E. Goodwin buoys, is a Refuge beacon with cage

on top, the main shaft of which penetrates the sand to the depth of 80 feet. The cage is 50 feet above the sand, and is reached by steps.

SOUTH SAND HEAD LIGHT-VESSEL, moored in 13 fathoms, about three-quarters of a mile to the south-west of the 5-fathom line at south extreme of the South Goodwin, exhibits at 38 feet above the sea a *fixed* white light, visible in clear weather from a distance of 10 miles. The light-vessel has one mast, is painted red, with the word South Sand head on her sides, and carries a ball at masthead. During foggy weather a gong is sounded, and a gun is fired if a vessel is seen standing into danger.

From the light-vessel, the South Foreland high lighthouse bears W. $\frac{1}{4}$ S. nearly 4 miles, and the Gull light-vessel N.N.E., 6 miles, with the Bunt head buoy nearly in line, $3\frac{7}{10}$ miles. Ripple mill, over Kingsdown church N.W. $\frac{1}{2}$ W., leads close to the northward of the light-vessel, and two-thirds of a mile southward of the South Sand head; and Upper Deal mill in line with Walmer castle, N.W. $\frac{3}{4}$ N., leads midway between the South Sand head and light-vessel.

GULL STREAM LIGHT-VESSEL, moored in $8\frac{1}{2}$ fathoms in the Gull stream, about seven-tenths of a mile westward of the 5-fathom western edge of the North Goodwin, exhibits at 36 feet above the sea a *revolving* white light, which attains its greatest brilliancy every *twenty seconds*, and is visible 7 miles. The vessel has one mast, carries a ball at masthead, is painted red, with the word Gull on her sides. During foggy weather a gong is sounded, and a gun is fired if a vessel is seen standing into danger.

From the light-vessel, the South Foreland high light is on with the south side of Old Stairs bay, S.W. $\frac{1}{4}$ W.; Ash church one-third from St. Peter's towards St. Clement's church at Sandwich, N.W. by W. $\frac{1}{2}$ W.; Middle Brake buoy N. by W., $1\frac{3}{10}$ miles; North Bar buoy, N.E. by N., $3\frac{1}{10}$ miles; Gull buoy, N.E. $3\frac{8}{10}$ miles; N.W. Goodwin buoy (the Goodwin Knoll buoy in line), E.N.E. $1\frac{8}{10}$ miles; N.W. Bunt buoy, S. by W., $1\frac{1}{2}$ miles; Bunt head buoy, S.S.W. $\frac{1}{4}$ W., $2\frac{1}{4}$ miles; and South Brake buoy, S.W. by W., $1\frac{3}{10}$ miles.

GOODWIN or NORTH SAND HEAD LIGHT-VESSEL, moored in 10 fathoms water, about a mile eastward of the 5-fathom north extreme of Goodwin knoll, is principally intended for the use of vessels coming from the northward to guide them eastward of the Goodwin sands. The vessel exhibits three *fixed* white lights on three separate masts; those on the fore and mizen are 28 feet, and that on the mainmast 42 feet, above the sea, thus forming a triangle, and are visible in clear weather 10 miles. The vessel has three masts, is painted red, has the word Goodwin on her sides, and carries a ball at each masthead. During foggy weather a gong is sounded, and a gun fired if a vessel is seen standing into danger.

From the light-vessel, the South Foreland high lighthouse bears S.W. by W., westerly; Ramsgate pier lighthouse, W.N.W.; North Foreland lighthouse, N.W. $\frac{1}{2}$ N., $6\frac{1}{4}$ miles; Kentish knock light-vessel (*revolving* light) N.N.E. $\frac{3}{4}$ E., 21 miles; and Galloper light-vessel (two *fixed* horizontal lights), N.E. $\frac{1}{4}$ E., 29 miles.

St. Peters church in line with Broadstairs cliff N.W. $\frac{1}{4}$ W., leads about $1\frac{1}{2}$ cables south of the light-vessel, and 6 cables north of the northern edge, in 20 feet water, of the Goodwin knoll. Ramsgate and St. Lawrence churches in line N.W. by W. $\frac{1}{2}$ W., leads about 3 cables south of the light-vessel, and just clears the northern edge, in about 30 feet, of the Goodwin knoll.

GOODWIN BUOYS.—The eastern side of the Goodwin is marked by the following four large nun buoys, and vessels are cautioned to keep half a mile eastward of them in passing, as the tide sets with great strength to the north-west towards and over the sands.

South Goodwin Buoy.—A high black and white chequered buoy, with staff and cage, lies in 14 fathoms water, with St. Lawrence church its breadth open west of Ramsgate mill, N. $\frac{3}{4}$ W.; Shakspeare cliff just open of South Foreland, W. $\frac{3}{4}$ S.; South Sand Head light-vessel W. $\frac{3}{4}$ S., $2\frac{8}{10}$ miles; and S.E. Goodwin buoy N.E. by E. $\frac{3}{4}$ E., $2\frac{1}{2}$ miles.

S.E. Goodwin Buoy, with black and white vertical stripes, and surmounted with staff and cage, lies in 17 fathoms, off the north part of the South Calliper, with the Lord Warden hotel at Dover just touching the South Foreland W. by S.; Northbourne mill in line with the time ball at Deal W.N.W.; East Goodwin buoy N.E. $\frac{3}{4}$ N., $2\frac{1}{2}$ miles; and Goodwin beacon N. $\frac{3}{4}$ E. $1\frac{6}{10}$ miles.

East Goodwin Buoy, chequered black and white, with staff and St. Andrew's cross, lies in 19 fathoms, with the Goodwin light-vessel just open westward of N.E. Goodwin buoy, N. by E. $\frac{1}{2}$ E.; Upper Deal mill open north of St. Saviours church at Deal West; the highest part of the north cliff of St. Margarets bay in line with Goodwin beacon W.S.W.; and N.E. Goodwin buoy N. by E. $\frac{3}{4}$ E., 2 miles.

N.E. Goodwin Buoy, with black and white vertical stripes, in 12 fathoms off the north-east edge of the Goodwin sand, with St. Lawrence church in line with the Royal hotel at Ramsgate, N.W.; Upper Deal mill on with South end of Deal hospital, W. by S.; Gull stream light-vessel W. $\frac{1}{8}$ N., $4\frac{3}{4}$ miles; Goodwin light-vessel N. by E. $\frac{1}{2}$ E., 2 miles; and Goodwin Knoll buoy N.N.W. $\frac{1}{4}$ W., 2 miles.

Goodwin Knoll Buoy, with black and white horizontal bands, lies in 5 fathoms on the north-west edge of the Goodwin knoll, which is nearly 2 miles in length in a general north-east and south-west direction,

off the north end of the Goodwin sand, from which it is separated by a channel 2 cables broad with from 6 to 8 fathoms water. The least water on this danger is 9 feet. From the buoy, Gull Stream light-vessel (N.W. Goodwin buoy in line) bears W.S.W., $1\frac{9}{10}$ miles; Gull buoy N.W. by W. $\frac{1}{4}$ W. $1\frac{9}{10}$ miles; North Foreland lighthouse N.N.W. $\frac{1}{2}$ W.; and Goodwin light-vessel E. $\frac{1}{2}$ N. $1\frac{4}{10}$ miles.

N.W. Goodwin Buoy, black, lies in 12 fathoms about 2 cables distant from the 5-fathom line on the N.W. side of the Goodwin, with St. Lawrence mill in line with the obelisk at Ramsgate N.N.W. $\frac{1}{2}$ W.; Northbourne mill in line with South end of No. 1 Battery W. $\frac{3}{4}$ S.; Middle Brake buoy W. by N. $\frac{1}{2}$ N., nearly 2 miles; North Bar buoy, N. $\frac{1}{4}$ E., $1\frac{9}{10}$ miles; and Gull buoy, N.N.E. $\frac{1}{2}$ E. $2\frac{3}{10}$ miles.

N.W. Bunt Buoy, can shaped and black, lies in 6 fathoms, with the first mill south of Sandown castle, on with Northbourne mill W. $\frac{3}{4}$ N.; the north end of coast-guard station at Old Stairs bay touching the chancel end of St. Margaret's church S.W. by W.; Gull stream light-vessel N. by E., $1\frac{9}{10}$ miles; South Brake buoy N.W. by W. $\frac{3}{4}$ W., one mile; and Bunt Head buoy S.W. $\frac{3}{4}$ S., $1\frac{2}{10}$ miles.

Bunt Head Buoy, black, lies in $5\frac{1}{2}$ fathoms water, with Upper Deal mill, its width open to the southward of St. Saviours church, West; Ramsgate pier lighthouse in line with St. Georges church, Ramsgate, N. $\frac{1}{2}$ E. northerly; South Brake buoy, N. $\frac{3}{4}$ W. $1\frac{4}{10}$ miles; and Deal bank buoy W. by N. $\frac{1}{2}$ N., $1\frac{4}{10}$ miles.

The GULL STREAM is the usual passage to the North Sea from the Downs, and for vessels proceeding up and down Channel. It divides the Goodwin from the Brake sand and the collection of detached shoals lying off Ramsgate, some of which extend to the middle of its northern part. These banks are marked by buoys, a description of which will now be given, commencing from the southward.

Deal Bank Buoy.—Deal bank, of which vessels in standing in-shore must be cautious, lies abreast of Deal, two-thirds of a mile off shore, and has only 18 feet at low water. A buoy chequered black and white lies in 4 fathoms water, on the east side of Deal bank, with the South end of Deal hospital on with Upper Deal mill W. by S.; Woodnesborough church just open of North end of Deal terrace N.W.; South Brake buoy N.E. $\frac{3}{4}$ E., $1\frac{1}{2}$ miles.

BRAKE SAND, about $4\frac{1}{2}$ miles in length, N.N.E. and S.S.W., and half a mile in breadth within the 2-fathom line, has several shoal patches on it, carrying from 2 to 9 feet water; the sand is marked by the following buoys:—

South Brake Buoy, with black and white horizontal bands, and staff and triangle, lies in 6 fathoms at the south extreme of the sand, with North

Foreland lighthouse open east of Broadstairs north cliff, N. by E. $\frac{3}{4}$ E. ; Upper Deal mill in line with the Time ball W.S.W. ; South Sand Head light-vessel S. by W. $\frac{1}{4}$ W., 5 miles ; and Middle Brake buoy N.N.E., $2\frac{2}{10}$ miles.

Middle Brake Buoy, chequered black and white, lies in 5 fathoms, near the east edge of the Brake sand, with the South Foreland high lighthouse S.W. $\frac{1}{4}$ S. ; Gull Stream light-vessel S. by E., $1\frac{3}{10}$ miles ; and North Brake buoy, $2\frac{1}{2}$ miles.

North Brake Buoy, with black and white vertical stripes, lies in 3 fathoms water on the north-eastern part of the sand, with the North Foreland lighthouse N. $\frac{1}{4}$ E. ; Ramsgate pier lighthouse N.W. by W. ; and St. Lawrence church in one with the east cliff at Ramsgate N.W. $\frac{1}{2}$ W.

North Bar Buoy.—The North bar is a small knoll with only 12 feet water on it, and marked by a buoy, with black and white horizontal bands, from which St. Clements church at Sandwich is its breadth open south of Woodnesborough church, W. $\frac{1}{4}$ S. ; St. Lawrence church N.W. $\frac{1}{3}$ W. ; Gull buoy E. by N., one mile ; North Sand Head light-vessel E. by S. $\frac{1}{4}$ S., $3\frac{3}{4}$ miles ; and Gull light-vessel S. W. by S.

Gull Sand Buoy.—Gull sand is a narrow ridge about a mile long, N.N.E. and S.S.W., with 3 fathoms on its shoalest part, which is near the middle. The south-east end of the shoal is marked by a chequered black and white conical buoy, which lies in 6 fathoms, with St. Lawrence church in line with the centre of Augusta stairs at Ramsgate N.W. by W., westerly ; South Foreland high lighthouse in line with the end of the north cliff of Old Stairs bay S.W. $\frac{1}{4}$ W., the lighthouse will also be nearly in line with the Gull Stream light-vessel ; Elbow buoy bears N. by E. $\frac{1}{8}$ E., $2\frac{1}{2}$ miles ; Goodwin light-vessel E. by S. $\frac{3}{4}$ S., $2\frac{3}{4}$ miles and North Brake buoy W. by N. $\frac{1}{2}$ N., $1\frac{6}{10}$ miles. Vessels of large draught should pass eastward of the buoy, as there are only 4 fathoms a quarter of a mile inside or westward of it.

Elbow Buoy.—The Elbow is a small shoal having 18 feet water on it, and is marked by a buoy, striped black and white vertically, with staff and cage, which lies in 5 fathoms close to the south-east edge of the danger, with the North Foreland lighthouse N.W. by W., westerly, $2\frac{1}{2}$ miles ; St. Lawrence church tower open north of Dumpton point, W. $\frac{1}{2}$ S. ; Gull buoy S. by W. $\frac{1}{3}$ W., $2\frac{1}{2}$ miles, and the east buoy of Margate sand N. by W. $\frac{1}{2}$ W.

As there are various shoal patches of 16 and 18 feet water between this shoal and the shore, the passage should never be attempted but by those well acquainted with its navigation.

Broadstairs Knoll Buoy.—In addition to the shoal patches between the Elbow and the shore, there are other numerous patches in the Inner

channel to Ramsgate, to the westward of the Elbow and Gull sands, which render it unfit for any vessels but those of light draught. Of these, the extensive knolls, lying off Broadstairs, have from 9 to 20 feet on them, and their outer edge is marked by a buoy chequered black and white which lies in $3\frac{1}{2}$ fathoms, with St. Georges church, Ramsgate, the apparent width of its tower open south of Hearson mill W. $\frac{1}{2}$ S.; St. Peters church tower, in line with the north side of the house on end of Broadstairs north cliff N.W. $\frac{3}{4}$ W.; Elbow buoy E. by N. $\frac{3}{4}$ N., $1\frac{3}{10}$ miles; Gull buoy S. by E. $\frac{1}{2}$ E., $2\frac{2}{10}$ miles; and North Brake buoy S.S.W. $\frac{1}{2}$ W., $1\frac{9}{10}$ miles.

ANCHORAGE in the DOWNS.—A good berth for large ships is in about 8 fathoms water over chalky bottom, with Upper Deal church a little open South of Deal castle, W. by N. $\frac{3}{4}$ N.; Sandwich church just seen north of Sandown castle, N.N.W. $\frac{1}{2}$ W., and the South Foreland high lighthouse—the low lighthouse is not seen—in the middle of Old Stairs bay, S.W. $\frac{1}{2}$ W. It is recommended that men-of-war and merchant ships of large draught should not anchor north of the line of Upper Deal church in one with Deal castle, and that vessels of about 16 feet draught should select that portion of the Downs to the northward of these marks anywhere near the line of East Bottom telegraph house in one with the highest part of the south extreme of Old Stairs bay. When anchored, take a bearing of the South Brake buoy, to enable the vessel to run for the Gull stream in case of parting or being obliged to slip. If moored, the hawse should be open to the southward.

The anchorage in the Small Downs, between Sandown castle and No. 2 battery and between the south end of the Brake and the shore, is much more secure than that in the Downs, and is recommended for vessels of less than 15 feet draught, as it is more sheltered, with better holding ground, and shoaler water; besides which vessels are not so liable to be fouled by drifting ships, and in cases of necessity they have greater facility for running to Ramsgate harbour.

TIME BALL.—A black ball is dropped daily from the mast in the Royal Naval yard at Deal, for the purpose of giving Greenwich mean time to passing vessels. The ball is hoisted half-mast high at five minutes and close up at three minutes before 1 p.m., and is dropped at the instant of 1 p.m. Greenwich mean time; the time to be noted being the instant the ball begins to fall from the cross arms of the vane. Should any derangement of the machinery prevent the ball from being dropped at 1 p.m., it will be kept at the masthead for ten minutes, and will then be lowered gradually; it will again be raised and dropped by hand, at 2 p.m. Greenwich time, but the accuracy of this time cannot be guaranteed within two seconds.

Deal Pier and Light.—A pile pier runs out 1,100 feet from the esplanade at Deal, and ships in the Downs can be supplied with fresh water from the pier into their own casks at any time of tide, as there is a depth of 10 feet at the pier end at low water. A *fixed red* light is exhibited from the outer end of the pier.

Life Boats.—A life boat is stationed at Kingsdowne, Walmer, and North Deal.

DIRECTIONS.—A vessel bound into the North Sea from abreast the South Foreland should either pass south of the South Sand Head light-vessel, and east of the Goodwin, or run through the Gull stream. If intending to take the latter route, round the Foreland at the distance of three-quarters of a mile, in 12 to 14 fathoms water, and when the South Foreland lighthouses are in one, W. by N., and Deal town opens of the cliffs, steer N.E. by N. till Sandown castle bears W.N.W.

The vessel will now be near the entrance of the Gull stream, and should haul a little to the northward to bring the South Foreland high lighthouse over the middle of Old Stairs bay about S.W. $\frac{1}{4}$ W., which mark kept on astern will lead between the Bunt head and South Brake buoys, and in the deepest water direct for the Gull light-vessel.

After passing the light-vessel close-to on either side, this mark may be again used till up to the Gull buoy, or keep the light-vessel on a S.W. $\frac{1}{2}$ W. bearing until the North Foreland lighthouse bears N.N.W., or the North Sand Head light-vessel E.S.E., when either steer to the north-eastward or haul up N. by E. $\frac{3}{4}$ E. till abreast the Elbow buoy, when a N.N.W. course may be steered for the east buoy of Margate sand, taking care to allow for a beam tide. These directions must be attended to at low water springs, by vessels drawing upwards of 15 feet, and these should pass eastward of the Gull buoy at that time of tide; the Gull light-vessel S.W. $\frac{1}{2}$ W., will lead well clear.

A vessel in the Downs parting her cables, or obliged to slip during a southerly gale and run through the Gull stream, should endeavour to bring the South Foreland high lighthouse over the middle of Old Stairs bay, S.W. $\frac{1}{4}$ W., or if the lighthouse is not seen, steer so to pass about 2 cables east of the South Brake buoy and then shape a course for the Gull light-vessel, and thence steer to the north-eastward with the light-vessel S.W. $\frac{1}{2}$ W., and when the North Foreland lighthouse bears N.N.W., or the North Sand Head light-vessel E.S.E., she may haul out to the eastward and lie to.

If wishing to regain her anchorage by turning to windward at the back of the Goodwin, do not in standing towards that sand bring the North Sand Head light-vessel eastward of North, nor come into less than 30 or 28 fathoms, until abreast of the S.E. Goodwin buoy, when the light-vessel

may be brought as far eastward as N.N.E. When the South Foreland lighthouses are in one, W. by N., she will be south of the Goodwin, and may bring Upper Deal mill in one with Walmer castle N.W. $\frac{3}{4}$ N., which will lead midway between the South Sand Head light-vessel and the Sand head, or she may pass the light-vessel close-to on either side, and bear up for the Downs.

A vessel should not attempt to turn through the Gull stream to the southward until half-ebb, or to the northward until half flood. In working to the southward, stand towards the Goodwin knoll, and along the north-west side of the North Goodwin, until the Gull light-vessel comes on with Deal castle, or outer end of Deal pier, S.W. by W. $\frac{1}{2}$ W.; and towards the Gull and other shoals forming N.W. side of Gull stream to 5 or 6 fathoms, or until the South Foreland high light-house is in line with the north cliff of Old Stairs bay.

Between North Bar shoal and Middle Brake buoy, stand toward Brake sand until the South Foreland high lighthouse appears about midway between Kingsdown and Walmer castle, and in line with Middle Brake buoy about S.W. $\frac{1}{2}$ S.; but between Middle and South Brake buoys stand no nearer than the line of the North Foreland lighthouse twice its apparent breadth open eastward of Broadstairs north cliff. When standing towards Bunt head, in the vicinity of N.W. Bunt buoy, the South Foreland high lighthouse may be brought on with East Bottom semaphore, or Gull Stream light-vessel, N.N.E.; but towards Bunt Head buoy large ships should not bring Gull Stream light-vessel to the northward of N.N.E. $\frac{1}{2}$ E.

To the southward of the Bunt Head buoy, or when the buoy and Sandown castle are in line N.W. $\frac{3}{4}$ W., a vessel may stand towards the Goodwin until the South Sand Head light-vessel bears S.W. $\frac{1}{2}$ S. Towards Deal, tack when East Bottom semaphore is in one with the south cliff of Old Stairs bay, or short of the chequered black and white buoy, to avoid Deal bank; and thence to the South Foreland the shore may be approached to any convenient depth.

RAMSGATE CHANNEL is to the westward of the Brake, between the Small Downs and Ramsgate, and the only dangers in it are the Cross ledge with 12 feet water on it, and a flat with 9 feet which extends from the shore abreast No. 2 battery. Vessels of more than 11 or 12 feet draught should not use this channel at low water springs, as there are not more than 12 or 13 feet in it from the Fairway buoy to Ramsgate, a distance of about 2 miles.

The channel is marked by three Fairway buoys as follows:—

South Fairway Buoy, striped red and white vertically, lies in 17 feet, and marks the eastern edge of the shoal flat off No. 2 battery. The buoy is distant half a mile from the inner edge of the Brake sand, and $2\frac{3}{4}$ miles

draught; but if drawing more than 12 feet anchor in Ramsgate Hole, which is easily found by bringing Minster mills in line with Cliff-end, and St. Lawrence church just open eastward of the two mills and square tower on the west cliff, in 18 feet water over clay bottom.

TIDES.—It is high water on full and change days at Ramsgate at 11h. 44m.; ordinary springs rise 13 feet, and neaps 10 feet; but these depths are increased 2 feet with northerly winds. The time and duration of high water level are much accelerated or retarded by prevailing winds; northerly winds rising the level rapidly on the flood, and causing it to hold up on the ebb in an extraordinary degree, whilst southerly winds are as decisive in creating contrary results.

About $2\frac{1}{2}$ hours before high water in the harbour the stream begins to set to the north-east, without the pier heads, and it continues in that direction for $5\frac{1}{2}$ hours. About one hour after the 10-foot signal is made there are 16 feet water with spring tides between the pier heads; and at two hours after, or at high water, there are 20 feet. With neap tides, one hour after the signal is made, there are 12 feet between the pier heads, and at two hours after, or at high water, there are 15 feet.

DIRECTIONS.—Running for Ramsgate from the Small Downs with a S.W. gale, weigh before the tide has done running to the southward, and steer so as to pass the eastward of the South Fairway buoy, and thence for the Middle Fairway buoy, from which Ramsgate lighthouse N.E. by N. will lead to the entrance: at night the red light on the west pier, and green light on east cliff will be in one, on same line of bearing.

The best time to enter if the vessel is not drawing more than 10 feet is two hours before high water, or when the tide begins to set to the north-east outside the pier heads. Pass close to the west pier head, taking care to keep a large diamond guide mark—white upon a black ground—on the landing platform full in view until the vessel is within the entrance.

If, when approaching the entrance, the tide is setting to the north-eastward, keep good sail on and close the North Fairway buoy, and steer for the west pier head—the vessel cannot be too close,—and if there is not time to run a warp to one of the buoys within the harbour, throw all aback, and let go the anchor; if no anchor, run the vessel on the East bank, directly towards the pier house.

Several vessels have narrowly escaped destruction by running for the harbour under insufficient sail to give them proper steerage way, and by keeping too far from the North Fairway buoy; thus crossing the stream of tide, instead of coming to the entrance before it.

Whilst the buoys are in position they will form the best guides for the channel, but a good leading mark is St. Lawrence church, appearing about

a quarter of the distance from West Cliff lodge towards Pugin's tower, N. by E., until Ramsgate lighthouse bears N.E. by N., when alter course for it, always taking care to avoid being carried past the entrance to the eastward.

As there are no good clearing marks for the west side of the Brake sand, vessels should not attempt to work through Ramsgate channel without local knowledge; for although the steep inner edge of this danger is generally marked by a ripple, no seaman would be justified in trusting the safety of his ship to such natural causes.

At Night vessels should not attempt to run for Ramsgate, except in case of extreme necessity; and to do this they should know their exact position before dark, with the bearing and distance of the South Fairway buoy. They should also keep a good look out for, and note the time the 10-foot water signal is made. The safest way is to run out through the Gull stream.

Should, however, a vessel from sheer necessity be compelled to run for Ramsgate from the Small Downs, a course should be shaped for the South Fairway buoy, and when abreast it (the Gull Stream light-vessel will bear about S.E. by E.) steer for the Middle Fairway buoy, and when the green lights on east cliff and east pier are in line, N.N.E. $\frac{1}{2}$ E., steer for them or borrow to the westward so as to bring the red or green light on the west pier in line with the green light on east cliff, N.E. by N.; both will lead towards the harbour's mouth. If the tide be running to the eastward, take care not to bring the light to the northward of N.E. by N. till the vessel almost touches the pier head, or she will be set to the eastward past the entrance.

OLD CUDD CHANNEL is the narrow passage between the Quern and the Dike, and carries a depth of 8 feet at low water springs. There is no difficulty in navigating this channel as a chequered black and white buoy marks the north end of the Quern, and a black buoy the south end of the Dike. To approach it by day, bring Mr. Pugin's house—which has a square tower and stands on the west cliff—its apparent breadth open south of the pier, N.W. by W. $\frac{1}{4}$ W.; steer with these marks on between the buoys, and then W. by S., and when Ramsgate church comes on with the end of the chalk cliff, the vessel will be past the shallows and may steer for the harbour.

The leading mark through the channel at night when there are less than 10 feet water at the entrance of the harbour is, the green light on the west cliff in line with the green light in the lighthouse; but when there are 10 feet and upwards at the entrance of the harbour, the green light in the lighthouse is not shown, and then the green light on the

west cliff and the red light in the lighthouse will lead through the channel.

This channel cannot be recommended to sailing vessels at night during an ebb tide, as it is attended with considerable risk. For when the western tide makes—at half ebb—it does not set fair through the channel, but shows action it on to the outer shoal, and if a vessel is not quick with her helm, she is on shore; this is continually happening with fishing vessels and small crafters; the cause is obvious, for the inner shoal curving off from the shore throws the tide obliquely across the channel.

BROADSTAIRS, a small but pleasantly situated watering place, about 2 miles north-east of Ramsgate, has a small harbour, formed by a pier extending from the northern side of the cove. The entrance faces the north-west, and is much exposed to the sea driven in by easterly winds. There are 16 feet at the pier end at high water springs, and 10 feet at neaps, but the harbour dries out at low tide.*

Life Boats.—Two life boats are stationed at Broadstairs, and one at Kingsgate.

TIDAL STREAMS.—It has already been observed in page 21, that the Channel streams at each end of Dover strait set uniformly in a direction towards Dover while the water is rising at that place, and away from it when it is falling. A vessel, therefore, if she carries the eastern stream or flood as far as Hastings, will have a continuation of easterly tide for 4 hours longer, and if sailing 8 knots, will nearly carry it to the North Foreland. If turning to windward, and she can get to the eastward of Hastings by high water, she may then advance as far as the West road, Dungeness, before the tide makes to leeward; but if not to windward of Hastings by an hour after high water, she will get no farther and may either keep under weigh or anchor for the tide, as convenient.†

Accidents of a fatal nature have occurred to ships running up Channel by being lost on the coast of France, in the vicinity of Boulogne, which have been attributed to the rotary action of the stream; but there is more reason to believe that they have been set to the eastward of their reckoning, and deeming themselves westward of Dungeness have been steering East, whilst they have been 10 miles beyond it, when probably the stream to the S.W. has begun to run, and catching them on the port bow, has set them over on the French shore (see page 22). The mariner therefore

* Directions for navigating between the North Foreland and the Nore are given in North Sea Pilot, Part 3, East Coast of England, Chapter 9.

† This description of the tidal streams in Dover Strait is by Captain F. Bullock, M.N., 1844.

will do well to study the set and turning of the stream given for every hour in page 252, and on no account to neglect the lead.

It is high water, full and change, at Beachy head at 11h. 20m. ; springs rise 20 feet, and neaps 15 feet. The stream in the offing begins to run to the eastward at low water, and continues to do so until high water, a similar law applying to the western stream.

At Eastbourne it is high water at 11h. 3m. ; springs rise $21\frac{1}{4}$ feet, neaps 17 feet ; at Hastings at 10h. 53m., rise 24 feet and $17\frac{1}{2}$ feet ; Dungeness at 10h. 45m., rise $21\frac{3}{4}$ feet and 19 feet ; and Boulogne at 11h. 25m., rise 25 feet and $19\frac{1}{2}$ feet.

Upon the Varne and Ridge it is high water at 10h. 40m. ; but the north-eastern stream does not commence there until $4\frac{1}{2}$ hours flood, nor the western stream till $4\frac{3}{4}$ hours ebb ; making $6\frac{1}{2}$ hours of north-eastern and $5\frac{1}{2}$ hours of south-western tide.

Strong gales from the westward will prolong the north-eastern stream nearly an hour, and retard proportionably that to the south-westward ; so that on some occasions, on the Ridge especially, 8 hours north-eastern tide, and only 4 hours to the south-westward, have been found.

Between the Vergoyer and the French shore the tide makes on an average one hour sooner than it does in the offing, both on the ebb and flood.

From Dover to Hastings the duration of the flood is always considerably less than the falling tide, the former flowing $5\frac{1}{4}$ h., and the latter ebbing 7h. ; but to the westward of Hastings, at Eastbourne, the duration of the two tides begins to equalize, the tide flowing 5h. 45m., and ebbing 6h. 40m.

Inshore, between Hythe and Dungeness, there will be found a slack during the strength of the eastern stream ; also from Hastings to Beachy head the flood runs easy. During the western stream the tide is easy between Hythe and Sandgate as far as Mill point ; and between Dungeness and Fairlight there is a slack which might be taken advantage of. Between Pevensey bay and the Hollywell bank the western stream commences at half an hour before high water ; and over the bank, and in Whitbread hole, there is a strong eddy setting down after half flood.

About one mile S.S.E. of the South Foreland lighthouse, the stream begins to set to the eastward about 1h. 30m. before high water on the shore at Dover, and runs from N.E. by E. to E.N.E. about $5\frac{1}{2}$ hours, or till 4 hours after high water ; it then turns and sets W. by S. $\frac{3}{4}$ S. about 7 hours. At Dover the flowing stream seldom continues more than 5 hours, and sometimes scarcely so much ; it is nearly the same at Ramsgate. To the northward of the South Foreland the streams change their direction to N.E. $\frac{1}{2}$ N. and S.W. $\frac{1}{2}$ S.

In the Downs the north-eastern stream begins about 1h. 20m. before high water at Dover, and continues to run 5h. 30m. ; it then turns and runs in a contrary direction till 2 hours before the ensuing high water.

In the Gull stream, one mile N.N.W. from the Bunt head, the northern stream begins about 1h. 30m. before high water at Dover, and continues for 6 hours ; it then turns and runs in a contrary direction till $1\frac{1}{2}$ hours before the ensuing high water. Its direction is N.E. $\frac{3}{4}$ N. ; but the last hour changes to E.N.E., and even to the southward of East ; the last hour of the southern stream changes from S.W. $\frac{3}{4}$ S. to W.S.W., and even to the northward of West.

TABLE OF POSITIONS
ON THE
SOUTH-WEST AND SOUTH COASTS OF ENGLAND, AND ON THE
NORTH COAST OF FRANCE.

SOUTH-WEST, AND SOUTH COASTS OF ENGLAND.

Place.	Particular Spot.	Latitude North.	Longitude West.
		° ' "	° ' "
Trevoze head - - -	Lighthouse - - -	50 32 55	5 2 3
Godrevy island - - -	Lighthouse - - -	50 14 0	5 24 0
St. Ives - - -	Lighthouse on pier head	50 12 0	5 28 0
Longships rocks - - -	Lighthouse - - -	50 4 4	5 44 44
Bishop rock - - -	Lighthouse - - -	49 52 30	6 26 36
St. Agnes island (Scilly) -	Lighthouse - - -	49 53 31	6 20 41
Seven Stones - - -	Light vessel - - -	50 3 10	6 7 20
Wolf rock - - -	Lighthouse (building) -	49 56 41	5 48 30
Runnelstone - - -	Summit - - -	50 1 26	5 40 18
Mount St. Michaels - - -	Summit - - -	50 7 3	5 28 37
Lizard head - - -	Eastern lighthouse -	49 57 34	5 12 4
Falmouth - - -	Turret of Pendennis castle.	50 8 44	5 2 45
Dodman point - - -	Extreme - - -	50 13 15	4 48 3
Gribbin head - - -	Beacon - - -	50 19 0	4 40 20
Looe island - - -	Summit - - -	50 20 17	4 27 0
Rame head - - -	Extreme - - -	50 18 42	4 13 23
Eddystone rock - - -	Lighthouse - - -	50 10 49	4 15 53
Plymouth Sound - - -	Dial on breakwater -	50 19 59	4 8 52
" " - - -	Signal staff in redoubt on Mount Wise.	50 22 0	4 10 15
Bolt head - - -	Summit - - -	50 13 10	3 48 45
Start point - - -	Lighthouse - - -	50 13 18	3 38 28
Dartmouth - - -	St. Petrox church -	50 20 30	3 33 55
Berry head - - -	Summit - - -	50 23 56	3 28 56
Torquay - - -	Lighthouse on pier head	50 27 30	3 31 0
Teignmouth - - -	Lighthouse on Denn -	50 32 35	3 29 36
Exmouth - - -	Church - - -	50 37 0	3 24 40
Bill of Portland - - -	Upper lighthouse -	50 31 18	2 27 18
Weymouth - - -	Beacon on pier head -	50 36 23	2 26 20
St. Albans head - - -	Extreme - - -	50 34 30	2 3 10
Poole - - -	Church - - -	50 42 46	1 59 18
Needles rocks - - -	Lighthouse - - -	50 39 40	1 35 27
St. Catherine point - - -	Lighthouse - - -	50 34 30	1 17 47
Portsmouth harbour - - -	Semaphore in dockyard	50 48 0	1 6 15
Owers shoals - - -	Light-vessel - - -	50 38 50	0 40 0
Brighton - - -	Pier head - - -	50 49 0	0 8 0W
Newhaven - - -	West pier head - - -	50 47 0	0 3 25

~~ALL INFORMATION CONTAINED~~

Part.	Particular spec.	Continued North.	Longitude.
		2	3
Beachy head	Lignitons	21 44 23	1 23 52 E
Longness	Lignitons	21 54 42	1 28 13
Prickstone	Lignitons	22 4 45	1 27 35
White head	Light vessel	21 56 23	1 24 31
Lowes	Castle	22 7 45	1 29 22
South Foreland	Lignitons	22 3 23	1 22 23
Isle of Cante	Centre	22 11 9	1 24 30
South Sand head	Light vessel	22 3 35	1 28 10
North Sand head	Light vessel	22 23 23	1 35 27
Kamagata	Lignitons in west part	22 23 42	1 25 23
South Foreland	Lignitons	22 23 35	1 26 45

SOUTH COAST OF FRANCE.

Île d'Orléans or Tahara	-	-	Lighthouse	-	-	43	28	30	5	3	32 W
Île Vierge	-	-	Lighthouse	-	-	43	36	23	4	34	11
Île de Paa	-	-	Lighthouse	-	-	43	44	45	4	1	44
Les Sept Îles	-	-	Lighthouse	-	-	43	52	46	3	29	33
Les Hâux de Bréhat	-	-	Lighthouse	-	-	43	54	33	3	5	17
Île Bréhat	-	-	Lighthouse on Poon point	-	-	43	51	53	2	59	17
Îles Saint Quay	-	-	Lighthouse on Harbour island.	-	-	43	40	2	2	48	37
Cap Frehel	-	-	Lighthouse	-	-	43	41	5	2	19	14
Saint Malo	-	-	Lighthouse on Mole des Voires.	-	-	43	38	40	2	1	53
Herpin rock	-	-	Summit	-	-	43	43	18	1	49	55
Mont Saint Michel	-	-	Telegraph	-	-	43	38	12	1	30	46
Roc de Granville or Cap Lihou.	-	-	Lighthouse	-	-	43	50	7	1	36	52
Isle Chauvsey	-	-	Lighthouse on S.E. point of Grande Ile.	-	-	43	52	13	1	49	26
Plateau des Minquiers	-	-	Maitresse Ile	-	-	43	58	17	2	3	52
Jersey island	-	-	Grande Anquette beacon	-	-	49	8	22	1	55	18
"	-	-	Seymour-tower	-	-	49	9	30	2	0	34
"	-	-	Ruin on Cape Grosnez	-	-	49	15	29	2	14	53
"	-	-	Lighthouse on Victoria pier, St. Helier	-	-	49	10	33	2	7	18
Guernsey island	-	-	Jerbourg tower	-	-	49	25	40	2	32	10
"	-	-	Lighthouse on Hanois or Hanoveaux rocks.†	-	-	49	26	2	2	42	10
"	-	-	Castle Cornet†	-	-	49	27	4	2	31	88
"	-	-	St. Peter Port, light-house.†	-	-	49	27	14	2	32	5
Alderney island	-	-	St. Anne's church	-	-	49	42	54	2	12	15
"	-	-	Ortach rock	-	-	49	43	27	2	17	33
"	-	-	Alderney mill†	-	-	49	42	26	2	12	46
"	-	-	Braye harbour light†	-	-	49	43	20	2	12	6

* The Positions on the French coast are from the *Pilote Français*, except those marked †, which are by Staff Commander John Richards, R.N.

NORTH COAST OF FRANCE—*cont.*

Place.	Particular Spot.	Latitude North.	Longitude.
Casquets islets - - -	North-east lighthouse -	49 43 17	2 22 42W
Régneville - - -	Lighthouse on Agon point - - -	49 0 32	1 34 56
Le Senequet - - -	Lighthouse on summit - - -	49 5 32	1 39 49
Le Bœuf - - -	Summit - - -	49 6 36	1 47 16
Cap de Carteret - - -	Lighthouse - - -	49 22 27	1 48 31
Cap de Flamanville - - -	Guardhouse - - -	49 31 23	1 53 0
Nez de Jobourg - - -	Extreme - - -	49 40 33	1 56 54
Cap de la Hague - - -	Lighthouse on Gros du Raz rock - - -	49 43 22	1 57 21
Cherbourg - - -	Lighthouse in fort Querqueville - - -	49 40 20	1 41 9
" - - -	Fort Central on break-water - - -	49 40 28	1 37 14
Cap Levi - - -	Lighthouse - - -	49 41 40	1 28 28
Cap de Barfleur - - -	Lighthouse - - -	49 41 50	1 16 2
Tour de la Hougue - - -	South extreme of fort -	49 34 19	1 16 27
Iles Saint Marcouf - - -	Lighthouse - - -	49 29 55	1 8 52
Grand Camp - - -	Lighthouse - - -	49 23 25	1 2 36
Pointe de Ver - - -	Lighthouse - - -	49 20 28	0 31 14W
Le Havre - - -	Lighthouse on N.W. jetty - - -	49 29 0	0 6 4E
Cap de la Hève - - -	Lighthouse - - -	49 30 43	0 4 2
Cap d'Antifer - - -	Summit - - -	49 41 17	0 9 46
Fécamp - - -	Lighthouse on Fagnet point - - -	49 46 5	0 22 6
Pointe d'Ailly - - -	Lighthouse - - -	49 55 7	0 57 29
Dieppe - - -	Lighthouse on west jetty -	49 56 2	1 4 57
Cayeux - - -	Lighthouse - - -	50 11 42	1 30 41
Cap d'Alprech - - -	Lighthouse - - -	50 41 57	1 33 41
Boulogne - - -	Lighthouse on S.W. jetty -	50 43 56	1 35 5
Cap Gris-Nez - - -	Lighthouse - - -	50 52 10	1 34 56
Calais - - -	Lighthouse - - -	50 57 45	1 51 7
Gravelines - - -	Lighthouse - - -	51 0 18	2 6 29
Dunkerque - - -	Lighthouse - - -	51 8 0	2 22 39

Showing the Time of HIGH WATER on Full and Change Days, with the rise at Spring and Neaps above the Mean Low Water Level of Ordinary Spring Tides, at the Principal Places on the SOUTH-WEST and SOUTH COASTS of ENGLAND.

Place.	High Water Full and Change.	Rise.		Place.	High Water Full and Change.	Rise.	
		Springs.	Neaps.			Springs.	Neaps.
	h. m.	ft.	ft.		h. m.	ft.	ft.
Scilly islands,				Christchurch harbour	{ 9 0 } { 11 30 }	5	—
„ St. Agnes	4 30	16	12	Needles point	- 9 46	7½	5
„ St. Marys	4 27	16	12	Atherfield point	- 10 20	8½	7
Newquay harbour	4 59	21	15	Hurst - - -	{ 10 0 } { 12 0 }	7½	6
Portreath „	4 51	21	15	Yarmouth - -	{ 10 0 } { 12 0 }	7	6½
St. Ives „	4 44	21	15	Cowes harbour	{ 10 45 } { 11 45 }	12½	9½
Longships -	4 35	20	14	Ryde pier -	- 11 20	13½	10
Mounts bay -	4 30	16	12½	Calshot point -	- 11 30	13	9½
Lizard - -	5 0	14½	10½	Southampton -	{ 10 30 } { 12 45 }	13	9½
Coverack cove	4 35	14½	11½	Portsmouth harbour:			
Falmouth harbour	4 57	16	12	Dockyard -	11 41	12½	10
Truro (town quay)	5 5	10	6	Off Porchester castle.	11 46	13½	10½
Mevagissey harbour	5 4	15½	12	A third of a mile west of Ports-bridge.	11 48	6½*	4*
Fowey harbour	5 14	15	11½	In channel close to Fareham upper quay.	11 47	11½	8½
East Looe -	5 26	16	13	Fareham bridge	11 51	7½	4½
Plymouth breakwater	5 37	15½	11½	Bembridge point	11 0	14	10½
Devonport dockyard	5 43	15½	11½	Langston harbour	11 40	13½	10½
River Tamar:				Chichester „	11 30	14	11
Saltash -	5 45	15	11	Pagham (entrance)-	11 30	16½	12½
Cargreen -	5 47	14½	10½	Selsea bill -	11 45	16½	12½
Pentillie -	5 55	13½	9½	Little Hampton	11 36	16	11½
Calstock -	6 6	12½	8½	Arundel (bar)	11 35	16	11½
Morwellham	6 12	10½	6½	„ (town)	12 25	16	11½
Weir head	6 17	5½	1½	Shoreham harbour	11 34	18	13½
River Tavy:				Brighton -	11 15	19½	16
Warleigh quay	5 47	14½	10½	Newhaven harbour	11 51	20	15
Maristow -	5 47	8½	4½	Beachy Head	11 20	20	15
Bigbury bay:				Eastbourne -	11 3	21½	17
River Yealm	5 37	16½	11½	Hastings -	10 53	24	17½
„ Erme -	5 40	16½	11½	Rye bay -	11 20	22	17½
„ Avon -	5 47	16½	11½	Dungeness -	10 45	21½	19
Bolt head -	5 45	15	11	Folkestone harbour	11 7	20	16½
Salcombe harbour	5 41	15	11½	Dover harbour	11 12	18½	15
Eddystone lighthouse	5 15	16	12	Deal - -	11 15	16	12½
Start point -	5 41	15	11½	Ramsgate harbour	11 44	15	12
Dartmouth harbour	6 16	14	10				
Teignmouth -	6 0	13	9½				
Torbay - -	6 0	13½	10				
Exmouth -	6 21	12½	8½				
Lyme Regis harbour	6 21	11½	8½				
Bridport harbour	6 5	11½	7½				
West bay, Chesilton	6 13	10½	7				
Portland bill -	6 35	9	6½				
„ breakwater	7 1	6½	4½				
Poole harbour	{ 0 10 } { 12 45 }	{ 6½ } { 4½ }	{ 4½ }				

* Above the bed of the channel.

GRAVING DOCKS.

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TABLE showing the Principal Dimensions of Private Graving Docks, &c., in the different Harbours on the SOUTH-WEST and SOUTH COASTS of ENGLAND.

Name of Port.	Graving Docks.				Patent Slips.	Grid-irons.	Rise of Tide.	
	No.	Length over all.	Breadth of Entrance.	Depth over Sill at High Water Ordinary Springs.			Springs.	Neaps.
Hayle - - -	1	ft. 250	ft. 48	ft. 15½	No. —	No. —	ft. 18½	ft. 12½
Penzance - - -	1	128	35	12	—	—	16	12½
Falmouth - - -	2	{ 400	65	16	—	1	13	—
Plymouth, Catwater	1	{ 350	50	14				
„ Sutton Pool	1	190	45	14	2	—	15½	11½
„ Mill Bay -	1	265	50	16	2	—	„	„
Dartmouth - - -	—	367	80	27½	—	—	„	„
Teignmouth - - -	—	—	—	—	2	—	14	10
Exmouth, Topsham	—	—	—	—	2	—	13	9½
Weymouth - - -	1	190	32	10	—	—	11½	8½
	—	—	—	—	2	—	6½	4½
Southampton - - -	3	{ 475	80	26½	—	—	13	9½
		{ 346	66	20½				
		{ 282	51	14½				
Cowes - - -	2	{ 330	56	16½	1	—	12½	9½
Portsmouth, Town	1	{ 140	36	12½				
„ Camber	—	345	50	17½	—	—	12½	10
„ Inner	—	—	—	—	1	—	„	„
„ Camber	—	—	—	—	—	—	—	—
New Shoreham - - -	—	—	—	—	2	—	18	13½
Newhaven - - -	—	—	—	—	—	1	20	15
Rye - - -	—	—	—	—	1	—	15½	10½
Folkestone - - -	—	—	—	—	1	—	17	13
Dover - - -	—	—	—	—	1	—	18½	15
Ramsgate - - -	1	143	33	11	1	—	15	12

TABLE* showing the MAGNETIC DIRECTION of the TIDAL STREAMS in the CHANNEL at every HOUR of the TIDE at DOVER.

Westward of a Line joining Ushant and the Lands End.

Hours.	North side of Lat. 49° N.						South side of lat. 49° N.	
	West part.	Rate.	Near Scilly.	Rate.	Seven Stones.	Rate.	West part.	Rate.
After High Water, Dover.	1 W. by N. $\frac{1}{2}$ N.	Greatest rate, springs, 1½ knots.	N.N.W. $\frac{1}{2}$ W.	Greatest rate, springs, 1½ knots.	N. $\frac{1}{2}$ W.	Greatest rate, springs, 1½ knots.	W. $\frac{1}{2}$ S.	Greatest rate, springs, 1½ knots.
	2 N. $\frac{1}{2}$ W.		N. $\frac{1}{2}$ W.		N.N.E.		N. by W. $\frac{1}{2}$ W.	
	3 N.E. $\frac{1}{2}$ E.		N.N.E.		N.E. $\frac{1}{2}$ N.		E. by N. $\frac{1}{2}$ N.	
	4 E. by N. $\frac{1}{2}$ N.		"		N.E. $\frac{1}{2}$ E.		"	
	5 "		N.E. by E.		N.E. $\frac{1}{2}$ E.		N.E. by E. $\frac{1}{2}$ E.	
	6 E. $\frac{1}{2}$ S.		E. $\frac{1}{2}$ S.		E. by N. $\frac{1}{2}$ N.		Turning.	
Before High Water, Dover.	1 S.E. by E. $\frac{1}{2}$ E.	Greatest rate, springs, 1½ knots.	"	Greatest rate, springs, 1½ knots.	S. $\frac{1}{2}$ W.	Greatest rate, springs, 1½ knots.	S. by E. $\frac{1}{2}$ E.	Greatest rate, springs, 1½ knots.
	2 S. $\frac{1}{2}$ E.		South.		S.S.W. $\frac{1}{2}$ W.		Draining.	
	3 S.S.W. $\frac{1}{2}$ W.		S.W.		S.S.W. $\frac{1}{2}$ W.		S.W. $\frac{1}{2}$ W.	
	4 S.W. by W.		S.W. by W.		S.W. $\frac{1}{2}$ S.		S.W. $\frac{1}{2}$ S.	
	5 W. by S. $\frac{1}{2}$ S.		"		W.S.W.		S.W. by W. $\frac{1}{2}$ W.	
	6 "		"		"		"	

Between { A Line joining the Lands End and Ushant,
 " " the Start and Casquets, and
 " " the Casquets and Sept Iles.

Hours.	North Side of Channel.					South Side of Channel.				
	West part.	Rate.	Centre.	Rate.	East part.	West part.	Rate.	Centre.	Rate.	East part.
After High Water, Dover.	1 W. by N. $\frac{1}{2}$ N.	Greatest rate, springs, 2 knots.	W. $\frac{1}{2}$ N.	Greatest rate, springs, 2 knots.	W. $\frac{1}{2}$ N.	W. $\frac{1}{2}$ S.	Greatest rate, springs, 2 knots.	W. $\frac{1}{2}$ N.	Greatest rate, springs, 2 knots.	W. $\frac{1}{2}$ S.
	2 Turning.		n.w. by w. $\frac{1}{2}$ W.		W. $\frac{1}{2}$ N.	Slack.		West.		W. by S.
	3 N. $\frac{1}{2}$ E.		W. $\frac{1}{2}$ N.		West.	East.		Slack.		W.S.W.
	4 E. $\frac{1}{2}$ S.		Slack.		S. $\frac{1}{2}$ W.	E. by N.		E. by S. $\frac{1}{2}$ S.		S.E. by S.
	5 East.		E. $\frac{1}{2}$ S.		S.E. $\frac{1}{2}$ S.	E. by N. $\frac{1}{2}$ N.		E. $\frac{1}{2}$ S.		S.E. by E. $\frac{1}{2}$ E.
	6 E. by S.		"		E. by S. $\frac{1}{2}$ S.	E. $\frac{1}{2}$ N.		S.E. by E. $\frac{1}{2}$ E.		S.E. $\frac{1}{2}$ S.
Before High Water, Dover.	1 E. by S. $\frac{1}{2}$ S.	Greatest rate, springs, 2 knots.	E. by S.	Greatest rate, springs, 2 knots.	E. by S.	E. $\frac{1}{2}$ S.	Greatest rate, springs, 2 knots.	E. by S.	Greatest rate, springs, 2 knots.	E. by S. $\frac{1}{2}$ S.
	2 Slack.		E. by S. $\frac{1}{2}$ S.		E. $\frac{1}{2}$ S.	n.e. by e. $\frac{1}{2}$ S.		Slack.		E. $\frac{1}{2}$ N.
	3 Turning.		Slack.		E. $\frac{1}{2}$ S.	Slack.		W.N.W.		North.
	4 W. by N.		W. $\frac{1}{2}$ N.		Turning.	s.w. by w. $\frac{1}{2}$ W.		Slack.		W. by N. $\frac{1}{2}$ N.
	5 W. $\frac{1}{2}$ S.		"		W. by S. $\frac{1}{2}$ S.	S.W. by W.		W. by N.		N.W. $\frac{1}{2}$ W.
	6 "		"		"	"		"		"

Between { A Line joining the Start and Casquets, and
 " " Beachy Head and Pointe d'Ailly.

Hours.	West part.	Rate.	Centre.	Rate.	East part.	Rate.	Over Hurd's Deep.	Rate.	Off Cape Barfleur.	Rate.
After High Water, Dover.	1 W. $\frac{1}{2}$ N.	Greatest rate, flood 2½ knots, ebb 2¼ knots.	W. by N. $\frac{1}{2}$ N.	Greatest rate, flood 3½ knots, ebb 3¼ knots.	Turning.	Greatest rate, flood 3½ knots, ebb 3¼ knots.	W. $\frac{1}{2}$ S.	Greatest rate, flood 2½ knots, ebb 2¼ knots.	N.W.	Greatest rate, flood 3½ knots, ebb 3¼ knots.
	2 W. by N. $\frac{1}{2}$ N.		N.W. by W. $\frac{1}{2}$ W.		W. by N. $\frac{1}{2}$ N.		"		"	
	3 W. $\frac{1}{2}$ N.		"		W. by N. $\frac{1}{2}$ N.		W. $\frac{1}{2}$ S.		"	
	4 W. $\frac{1}{2}$ S.		W.N.W.		W. $\frac{1}{2}$ N.		W.S.W.		"	
	5 "		"		W. by N.		W. by S. $\frac{1}{2}$ S.		"	
	6 N.N.E. $\frac{1}{2}$ E.		W. by N. $\frac{1}{2}$ N.		"		Slack.		"	
Before High Water, Dover.	1 E. $\frac{1}{2}$ S.	Greatest rate, flood 2½ knots, ebb 2¼ knots.	E.S.E.	Greatest rate, flood 3½ knots, ebb 3¼ knots.	E. by S. $\frac{1}{2}$ S.	Greatest rate, flood 3½ knots, ebb 3¼ knots.	E. $\frac{1}{2}$ S.	Greatest rate, flood 2½ knots, ebb 2¼ knots.	"	Greatest rate, flood 3½ knots, ebb 3¼ knots.
	2 E. by S. $\frac{1}{2}$ S.		S.E. by E. $\frac{1}{2}$ E.		E. by S. $\frac{1}{2}$ S.		"		"	
	3 "		"		E. by S. $\frac{1}{2}$ S.		E. $\frac{1}{2}$ S.		S.E.	
	4 "		"		"		"		"	
	5 "		"		"		E. $\frac{1}{2}$ N.		"	
	6 "		E.S.E.		E. $\frac{1}{2}$ S.		E.N.E.		"	

* In this Table the time of high water at Dover is taken as a standard, so that to find either the time of turn or the direction of the stream in the Channel, compare the mean time of ship with the time of high water at Dover, and the interval between in the column answering to the ship's position will be the information required. The description of the Tidal streams is given in page 20.

Entrance of Gulf of St. Malo on a line joining Ile Brehat and S.W. side of Guernsey Island.

Hours.	12 miles from Brehat.		12 miles from Guernsey.		Near S.W. point of Guernsey.		4 miles W. by S. from Casquets.		4 miles W.N.W. of Cape de la Hague.	
	Course.	Rate.	Course.	Rate.	Course.	Rate.	Course.	Rate.	Course.	Rate.
After High Water, Dover.	1 N.W. by W.	Uncertain.	W. $\frac{1}{2}$ N.	Uncertain.	W. $\frac{1}{2}$ N.	Uncertain.	W. $\frac{1}{2}$ S.	Uncertain.	S.W. by W. $\frac{1}{2}$ W.	Greatest rate, springs, $\frac{1}{2}$ to $\frac{1}{2}$ knots.
	2 S. $\frac{1}{2}$ W.		S. $\frac{1}{2}$ W.		S.S.W. $\frac{1}{2}$ W.		S.W. $\frac{1}{2}$ W.		"	
	3 S. $\frac{1}{2}$ W.		S. $\frac{1}{2}$ W.		"		"		"	
	4 S.E. $\frac{1}{2}$ S.		S.S.E. $\frac{1}{2}$ E.		S.E. by E. $\frac{1}{2}$ E.		S. by E. $\frac{1}{2}$ E.		S.W. $\frac{1}{2}$ S.	
	5 " "		S.E. $\frac{1}{2}$ E.		"		S.E. $\frac{1}{2}$ E.		"	
Before High Water, Dover.	6 S.E. $\frac{1}{2}$ S.	Uncertain.	S.E. $\frac{1}{2}$ E.	Uncertain.	"	Uncertain.	"	Uncertain.	N.E. by E. $\frac{1}{2}$ E.	
	7 S.E. $\frac{1}{2}$ E.		S.E. by E.		S.E. by E. $\frac{1}{2}$ E.		E. $\frac{1}{2}$ N.		"	
	8 ..		..		E. $\frac{1}{2}$ N.		N.E. $\frac{1}{2}$ N.		"	
	9 N.W. by W.		N.W. $\frac{1}{2}$ N.		S.E. by E. $\frac{1}{2}$ E.		"		N.E. $\frac{1}{2}$ N.	
	10 " "		N.W. $\frac{1}{2}$ W.		E. $\frac{1}{2}$ N.		N.E. by E. $\frac{1}{2}$ E.		"	
Before High Water, Dover.	11 N.W. $\frac{1}{2}$ W.	Uncertain.	W. by N. $\frac{1}{2}$ N.	Uncertain.	N. by W. $\frac{1}{2}$ W.	Uncertain.	N.W. $\frac{1}{2}$ W.	Uncertain.	"	
	12 " "		..		"		"		"	

In the Baie de la Seine, south of a line joining Cape Barfleur and Cape Antifer.

Hours.	West Part.	Rate.	Centre.	Rate.	East Part.	Rate.
After High Water, Dover.	1 N.N.W. $\frac{1}{2}$ W.	Greatest rate, } flood 4'2" } ebb 3'7"	N.W. by W. $\frac{1}{2}$ W.	Greatest rate, } flood 3'2" } ebb 3'2"	W. $\frac{1}{2}$ N.	Greatest rate, } flood 3'3" } ebb 3'0"
	2 N.N.W. $\frac{1}{2}$ W.		"		W. $\frac{1}{2}$ S.	
	3 N.N.W.		"		W. by N. $\frac{1}{2}$ N.	
	4 N.N.W. $\frac{1}{2}$ W.		"		W. $\frac{1}{2}$ N.	
	5 Slack.		N.W. by W. $\frac{1}{2}$ W.		"	
Before High Water, Dover.	6 S.S.E.	Greatest rate, } flood 4'2" } ebb 3'7"	S.E. by E. $\frac{1}{2}$ E.	Greatest rate, } flood 3'2" } ebb 3'2"	W. $\frac{1}{2}$ S.	Greatest rate, } flood 3'3" } ebb 3'0"
	7 " "		"		"	
	8 " "		"		E. by N. $\frac{1}{2}$ N.	
	9 S.E. by S.		"		E. by N. $\frac{1}{2}$ N.	
	10 " "		"		"	

Between { A line joining Beachy Head and Pointe d'Ailly, and the North Foreland and Dunkerque.

Hours.	REMARKS.	West of	East of	South Sand Head.		North Sand Head.	
		Line of Separation.		Course.	Rate.	Course.	Rate.
After High Water, Dover.	1 The Tides separate on a line joining, Beachy Head and St. Valery	W. by N.	N.E. by E. $\frac{1}{2}$ E.	N.E. $\frac{1}{2}$ E.	Greatest rate, springs, $\frac{1}{2}$ knots.	N.N.E.	
	2 Hastings and Treport	W. $\frac{1}{2}$ N.	N.E. $\frac{1}{2}$ E.	N.E. $\frac{1}{2}$ E.		N.N.E.	
	3 Hastings and Cayeux	W. $\frac{1}{2}$ N.	N.E. $\frac{1}{2}$ E.	N.E. $\frac{1}{2}$ E.		N.N.E.	
	4 Folkestone and Calais	W. by S.	"	N.E. by E. $\frac{1}{2}$ E.		E. by S.	
	5 South Foreland and Gravelines	S.W. by W. $\frac{1}{2}$ W.	N.E. by E. $\frac{1}{2}$ E.	"		"	
Before High Water, Dover.	6 Ramsgate and Nieuport, passing over North Sand Head, the south line of the Falls, and the banks off Nieuport	W. by S.	{ E. $\frac{1}{2}$ N. and Northward.	S.W. $\frac{1}{2}$ S.	Greatest rate, springs, $\frac{1}{2}$ knots.	S.S.W.	
	7 The Tides meet on a line joining, Beachy Head and Pointe d'Ailly	Line of meeting.	E.S.E.	S.W. by W. $\frac{1}{2}$ W.		"	
	8 Bexhill and Cayeux, both streams turning down towards the River Somme	S.S.E. $\frac{1}{2}$ E.	S. by W. $\frac{1}{2}$ W.	S.W. $\frac{1}{2}$ W.		"	
	9 Rye and the Somme, passing over the Bassurelle, both tides setting to the Somme	S.E. by E. $\frac{1}{2}$ E.	S.W. by W.	W. by S. $\frac{1}{2}$ S.		"	
	10 Dungeness and Touquet point	E. by N.	W. by S. $\frac{1}{2}$ S.	W. $\frac{1}{2}$ N.		"	
	11 Dover and Dunkerque nearly	N.E. by E. $\frac{1}{2}$ E.	W.S.W.	N.N.E.		"	
	12 " "	"	"	"		"	

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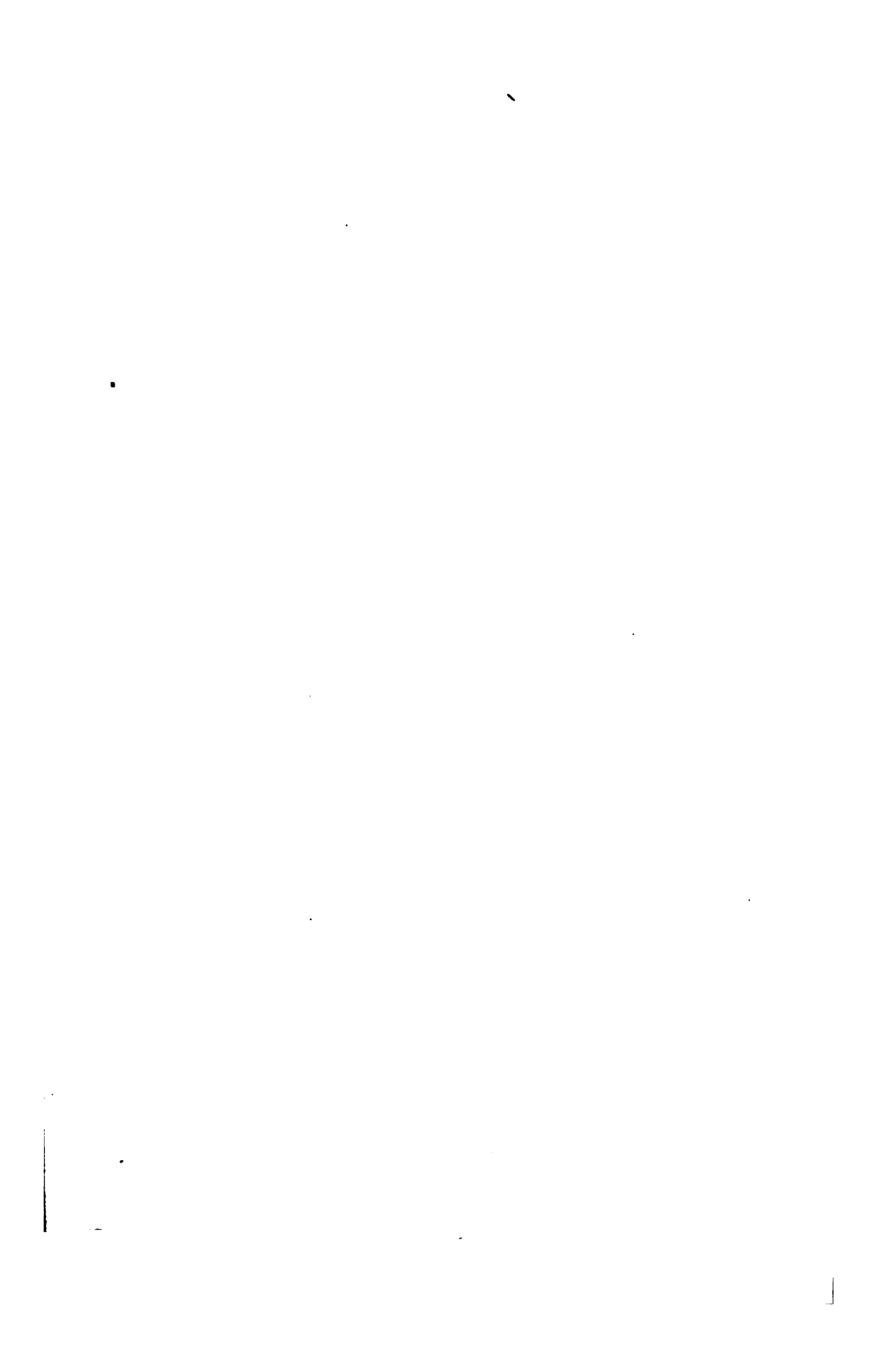
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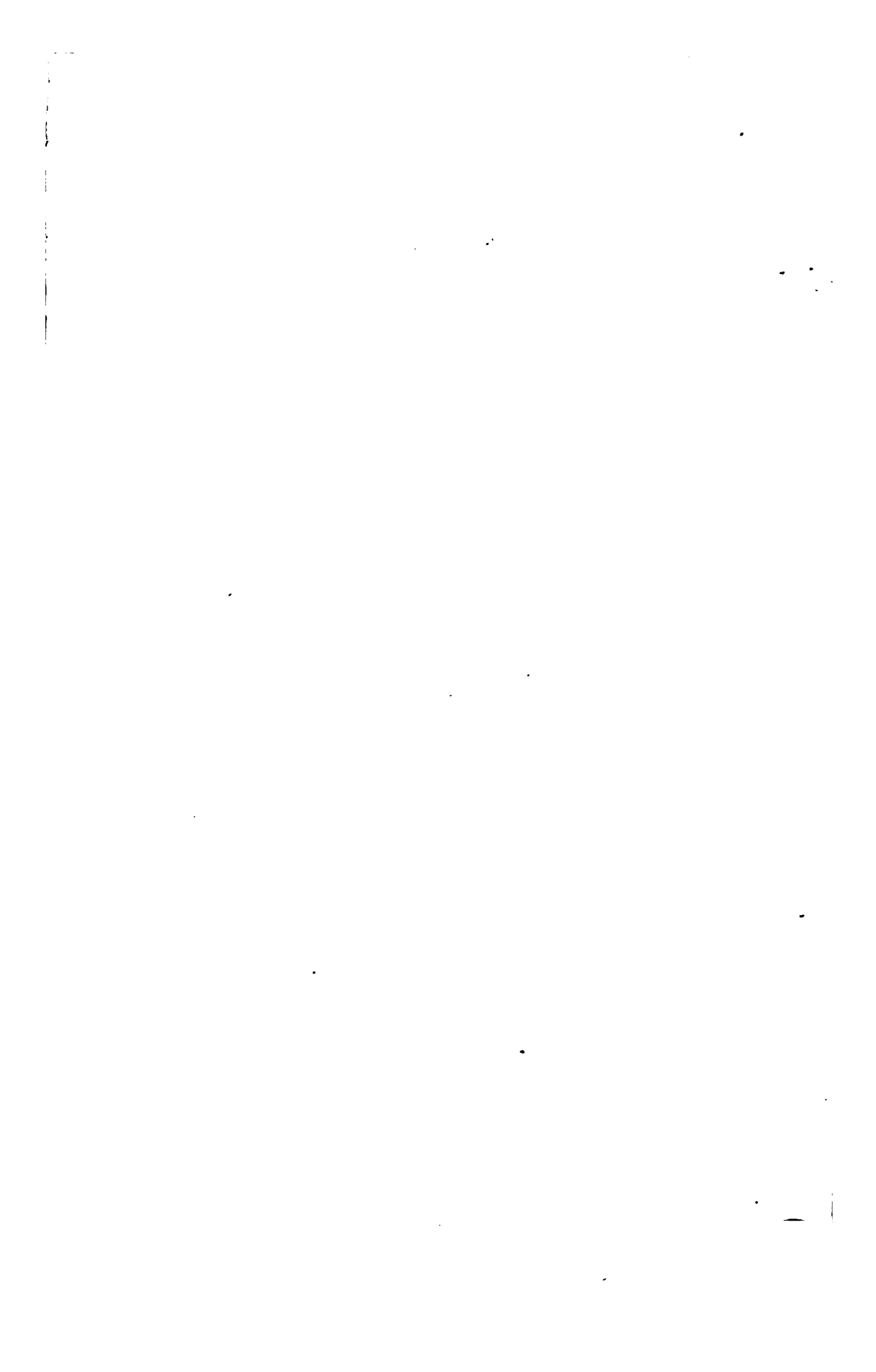
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